

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-217119
(43)Date of publication of application : 10.08.1999

(51)Int.CI. **B65G 49/00**
B65G 49/07

(21) Application number : 10-067625

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(22) Date of filing : 04.03.1998

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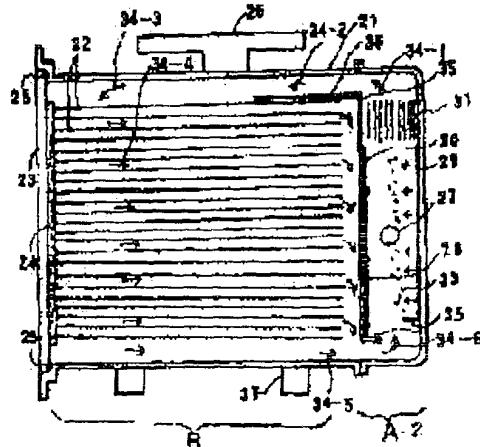
Priority number : **09341893** Priority date : **28.11.1997** Priority country : **JP**

(54) CARRIER BOX FOR SEMICONDUCTOR SUBSTRATE

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a carrier box for semiconductor substrates which has a practically efficient function of removing particles and gas toxic components.

SOLUTION: A semiconductor substrate box is a gas purification unit formed by integrating a gas purification device A-2 which purifies the box inside by using photoelectron and photocatalyst by optical irradiation or a battery mounted power supply device with charging function for feeding the power to the gas purification device with a semiconductor substrate carrier box 21 having an opening/closing mechanism for putting in/out the semiconductors. This gas purification device A-2 is provided with an ultraviolet ray source 27 for optical irradiation, a photoelectron emission material 29 for emitting the photoelectron, and photocatalyst 28, and when it is integrated with a power supply device, a heat radiating body for transmitting the heat generated in the power supply device to the gas purification device A-2 is preferably provided therein and the material of the carrier box 21 may be synthetic resin.



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CLAIMS

[Claim(s)]

[Claim 1] The conveyance box for semiconductor substrates characterized by having the gas defecation unit which united the gas defecation equipment using the photoelectron and/or photocatalyst by optical irradiation for defecating the inside of a box with this box in the conveyance box for semiconductor substrates which has the breaker style which can go a semiconductor substrate in and out.

[Claim 2] The conveyance box for semiconductor substrates characterized by to have the gas defecation unit which united with this box the gas defecation equipment using the photoelectron and/or photocatalyst by optical irradiation for defecating the inside of a box, and the power unit with a dc-battery loading charge function which supplies power to this equipment in the conveyance box for semiconductor substrates which has the breaker style which can go a semiconductor substrate in and out.

[Claim 3] The aforementioned conveyance box is a conveyance box for semiconductor substrates according to claim 1 or 2 characterized by material being synthetic resin.

[Claim 4] The aforementioned gas defecation unit is a conveyance box for semiconductor substrates according to claim 2 characterized by having a radiator for telling generation of heat in a power unit to gas defecation equipment.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the conveyance box for semiconductor substrates, especially relates to the conveyance box (carrier box) which contains and conveys substrates, such as Si wafer in frontier industries, such as a semiconductor, liquid crystal, and the precision machinery industry, a glass substrate, and a metallic-coating substrate.

[0002]

[Description of the Prior Art] Drawing 18 is used and air clarification [in / a semiconductor plant / for air clarification in the conventional clean room] is explained to an example. In drawing 18, coarse grain is first removed by the pre-filter 2, subsequently the open air 1 is air-conditioned with the air-conditioning machine 3, and dust removing is carried out with the neutral ability filter 4. Next, a detailed particle is removed by the high efficiency particulate air filter (high efficiency filter) 6 currently installed in the ceiling section of a clean room 5, and, as for a clean room 5, classes 100-1,000 are maintained ("washing design" p.11-24, Summer 1988). 7-1 and 7-2 show a fan, and an arrow shows the flow of air. Since it aimed at particle removal, air clarification in the conventional clean room was constituted like drawing 18. With such composition, although it is effective for particle removal, there is no effect in removal of a gas-like injurious ingredient.

[0003] On the other hand, in the clean room of a large room method like drawing 18, the technical problem that cost overly starts too much to clean-izing occurs (41 BREAK THROUGH and No. 5 p.38- 1993). By the way, in addition to that quality improvement of a product and elaboration of a particle (particulate matter) are natural in connection with a **** lead and this, and a particle, by semiconductor industry, the gas-like matter will involve as a contamination from now on. That is, it becomes important [control of the gas-like matter (gas-like injurious ingredient)] conventionally that just particle removal was enough as from now on. Since it will be introduced into a clean room, without removing only a particle but removing the gas-like injurious ingredient from the open air with the filter of the conventional clean room which this showed to aforementioned drawing 18, it is because it becomes a problem.

[0004] namely, a clean room -- setting -- a particle (particulate matter) and an old dust filter (an example --) In HEPA and a ULPA filter, a uptake, the exhaust gas of the automobile which will not be removed but will be introduced in a clean room, Gas-like matter, such as organic nature gas called hydrocarbon (H. C.) which originates in degasifying etc. from the macromolecule resin product currently widely used as a consumer product, and NH₃, basic (alkalinity) gas like an amine, poses a problem as a gas-like injurious ingredient. Among this, since the thing of the super-low concentration in usual air (indoor air and open air) brings about contamination as a gas-like injurious ingredient, it is necessary to remove H.C. Moreover, recently, degasifying from the macromolecule resins of the component of a clean room or a use instrument (an example, wafer receipt box) poses a problem as an H.C. generation source (49 Japan Machinery Federation, the report in the Heisei 6 fiscal year, March, Heisei 7, p.41- 1995).

[0005] What was generated in the work [these gas-like matter] in a clean room poses a problem. That is, since the gas-like matter generated in the aforementioned clean room to the gas-like matter (the gas-like matter in the open air will be introduced with the filter in a clean room since the gas-like matter is unremovable) introduced from the open air in the usual clean room is added as a reason of this gas-like matter, compared with the open air, the gas-like matter in a clean room serves as high concentration, and pollutes a wafer base material and a substrate. That is, if the above-mentioned pollutant (a particle, gas-like injurious ingredient) adheres to the substrate front face of a wafer, half-finished products, and a product, a particle will cause an open circuit and short circuit of the circuit on the front face of a substrate (pattern), and will produce a defect. Moreover, as gas-like matter, if ** H.C. adheres to a wafer (substrate) front face, the increase in a contact angle will be brought about and H.C. will affect the compatibility (concordance) of a substrate and a resist. And if compatibility becomes bad, it will have a bad influence on the thickness of a resist, or it has a bad influence on the adhesion of a substrate and a resist (21 air clarification, the 33rd volume, No. 1, p.16- 1995). Moreover, H.C. causes proof-pressure degradation (fall of reliability) of the oxide film of a wafer (686 the collection of the 39th applied-physics relation union lecture meeting drafts, p. 1992).

[0006] ** NH₃ generation of an ammonium salt etc. -- bringing -- a wafer -- becoming cloudy (resolving being poor) -- it causes (25 p.15- a rear rice company, the latest technical lecture, the collection of data, a semiconductor process seminar, October 29, 1996, 1996) According to such a cause, not only these gaseous pollutants but also the productivity (yield) of a

semiconductor product reduce a particle. Since especially the above-mentioned gas-like matter as a gas-like injurious ingredient makes [many] circulation of clean room air and is used in the viewpoint of energy saving according to an above-mentioned generating reason recently again, the concentration of the gas-like matter in a clean room is condensed, is remarkable high concentration compared with the open air, adheres to a base material or a substrate, and pollutes this front face. When the grade of this contamination can be expressed with the contact angle of a base material or a substrate and is intense, its contact angle is large. [of contamination] Even if it forms membranes on the front face, a membranous bond strength imitates the fall of the yield weakly (concordance is bad), and the base material and the substrate with a large contact angle are **.

[0007] Here, a contact angle is a contact angle of the wetting by water, and the grade of contamination on the front face of a substrate is shown. That is, if the pollutant of a hydrophobic property (oiliness) adheres to a substrate front face, the front face will crawl water again and will stop being able to wet wet easily. Then, the contact angle of a substrate front face and waterdrop becomes large. Therefore, when a degree of contamination is high when a contact angle is large, and a contact angle is conversely small, a degree of contamination is a low. In order to carry out the cyclic use of waste water of the air of a clean room in respect of energy saving especially recently, the gas-like injurious ingredient in a clean room will increase gradually, and will pollute a base material and a substrate.

[0008] It considers as the cure which carries out the pollution control of the substrate from such a pollutant, and conveyance by (1) robot is effective. That is, since people are raising dust and a source of ** gas, it is important for them to lose people's mediation for air-cleanliness-class maintenance (116 monthly Semiconductor world, the January issue, p.112- 1997). (2) Moreover, in respect of clean-izing, it is proposed that clean-izing of future space has the effective formation (mini en BAIROMENTO) of partial clean which limits pure space (localization) (378 ** NIKKEI MICRODEVICES, the July issue, p.136- 141, 1995, ** Proceedings of IES, p.373- 1994). Although the method which contains Si wafer in the box made of synthetic resin (plastics), and conveys it as such mini en BAIROMENTO now is examined (1) (2) to which particle contamination becomes serious on the contrary when raising dust breaks out suddenly from the interior The cure to degasifying (shot gas) from box material is the need and (3). By (1) and (2) since the process which carries out routine cleaning of the box itself increases, it becomes complicated and is a problem practically -- etc. -- there is indication (10 a KANOMAX aerosol seminar, p.1- 1996) Being in such inside, this invention persons have proposed the clean-ized method of the space which uses a photoelectron and a photocatalyst as partial clean-ized technology.

[0009] for example, -- 1 it is based on a photoelectron -- pure -- method (removal of particulate matter):JP,3-5859,B, JP,6-74909,B, JP,8-211,B, JP,7-121367,B, and 2 it is based on a photocatalyst -- pure -- method (removal of gas-like injurious ingredient):JP,9-168722,A, JP,9-205046,A, and 3 combined use method [of a photoelectron and a photocatalyst] (simultaneous removal of particle and gas): -- there is JP,1-266864,A Depending on an application place (kind of equipment), or a military requirement, by the aforementioned pure method, although these pure methods were effective, they need to improve the usage suitably depending on an application place or a military requirement. In this improvement, there was a problem of improving so that it may become practically much more effective. As one of the problem of the, these aforementioned pure methods make a gas fluidize by generation of heat by the light sources, such as ultraviolet rays, and are performing cleaning. That is, it was important how this gas is effectively fluidized depending on the application place of the aforementioned pure method, and it was the problem which should improve.

[0010]

[Problem(s) to be Solved by the Invention] Then, this invention makes it a technical problem to offer the conveyance box for semiconductor substrates which has the removal function of a particle practically effective as a conveyance box for semiconductor substrates of mini en BAIROMENTO where a request is increasing, and/or a gas-like injurious ingredient in view of the above-mentioned conventional technology as quality improvement of a product, elaboration, and detailed-ization progress in frontier industries, such as a semiconductor, liquid crystal, and the precision machinery industry.

[0011]

[Means for Solving the Problem] conveyance box **** for semiconductor substrates which has the breaker style which can go a semiconductor substrate in and out in this invention in order to solve the above-mentioned technical problem -- it considers as the conveyance box for semiconductor substrates characterized by having the gas defecation unit which united the gas defecation equipment using the photoelectron and/or photocatalyst by optical irradiation for defecating the inside of a box Moreover, in this invention, it considers as the conveyance box for semiconductor substrates characterized by to have the gas defecation unit which unified the gas defecation equipment using the photoelectron and/or the photocatalyst by optical irradiation for defecating the inside of a box, and the power unit with a dc-battery loading charge function which supplies power to this equipment in this box in the conveyance box for semiconductor substrates which has the breaker style which can go a semiconductor substrate in and out.

[0012] As for the aforementioned conveyance box, it is good to make material into synthetic resin, and when a power unit is unified, as for the aforementioned gas defecation unit, it is good to have a radiator for telling generation of heat in a power unit to gas defecation equipment. Moreover, when the aforementioned gas defecation unit is not unifying the power unit, in response to an electric power supply, it operates by connection with the power supply installed in the load port, the waiting circle place in the waiting for a process, the stocker, etc. in the intervals of conveyance of this conveyance box (at the times other than conveyance).

[0013]

[Embodiments of the Invention] The conveyance box for semiconductor substrates of this invention has the breaker style to which a semiconductor substrate can be gone receipt and for taking out in and out in a box, the gas defecation equipment (gas defecation unit) using the photoelectron and/or photocatalyst by optical irradiation for defecating the inside of a box is unified, and this unit can be suitably removed from a box. By connection with the power supply installed in the load port, the waiting circle place in the waiting for a process, the stocker, etc. in the intervals of use of original as conveyance of a box (between other than conveyance), an electric power supply is received, it operates, and, as for the aforementioned gas defecation equipment, cleaning of the gas in the box where the substrate was contained by this is performed. Moreover, the conveyance box for semiconductor substrates of this invention The gas defecation equipment using the photoelectron and/or photocatalyst by optical irradiation for having the breaker style to which a semiconductor substrate can be gone receipt and for taking out in and out in a box, and defecating the inside of a box, It has a power unit with a dc-battery loading charge function for supplying power to this equipment, they are unified (gas defecation unit), and this unit can be suitably removed from a box.

[0014] Furthermore, this unit can be equipped with the radiator which tells generation of heat from a power unit to the gas defecation equipment which uses a photoelectron and/or a photocatalyst. The box of these this inventions may contain a semiconductor substrate, and can convey and/or keep it, and any are sufficient as it as long as it is the container which can be sealed. For example, there are metal and a product made of synthetic resin. The product made from aluminum is desirable at the lightweight point in the thing made from this money-paid-on-account group. Moreover, in the case of synthetic resin, although it may excel in processability, rigidity, and endurance, and any are sufficient as long as ** gas is a few material, if it is the thing of transparency, in addition, it is desirable. For example, there are engineering plastics, such as general-purpose plastics, such as ABS and an acrylic, and a polycarbonate (P. C.), and super engineering plastics which are polyether imide etc. further.

[0015] The breaker style of a box may be the aforementioned box in which the gas defecation equipment using the below-mentioned photoelectron and/or below-mentioned photocatalyst of this invention can be installed and which can be sealed, and any are sufficient as it as long as receipt and ejection can do a substrate suitably. For example, the breaker style of a box consists of a box door, a wafer presser foot, and a sealant, it is unified, and after making a box door engage with a door opener (standard [for SEMI J]) and pulling out from a box main part horizontally, a box door is wide opened from a box main part by reducing in a lower part line. As an example of such a box, it is the position of an opening-and-closing door, and the receipt gestalt (is a substrate contained to an oven cassette or not?) of a substrate to 1. A horizontal aperture one apparatus conveyance box and 2 An open cassette receipt type horizontal aperture conveyance box and 3 There is an oven cassette receipt type bottom aperture conveyance box.

[0016] Next, the gas defecation equipment by the photoelectron and/or photocatalyst which can do removal suitably is stated to the box which has the aforementioned breaker style which is the feature of this invention. The flow (natural circulation) of the gas using generation of heat within equipment [pollutant / in a box] removes this equipment effectively by installing in the one section in a box. First, the composition is explained below about the defecation equipment by the photoelectron. The defecation equipment by the photoelectron is the electrode material for electric fields for photoelectric-emission material, a ultraviolet ray lamp, and photoelectric emission, electric charge particle uptake material, and a thing that is constituted more and removes a particle. If a photoelectron is emitted by irradiation of ultraviolet rays, any are sufficient as photoelectric-emission material, and its photoelectricity-work function is [a smaller thing] more desirable. From the field of an effect or economical efficiency Ba, Sr, calcium, Y, Gd, La, Ce, Nd, Th, Pr, Be, Zr, Fe, nickel, Zn, Cu, Ag, Pt, Cd, Pb, aluminum, C, Mg, Au, In, Bi, Nb, Si, Ti, Ta, U, B, Eu, Sn, P, or W Or these compounds, an alloy, or mixture is desirable, and these are independent, or two or more sorts are compounded and it is used. As a composite, a physical composite can also be used like amalgam.

[0017] For example, there are an oxide, a way ghost, and carbide as a compound. To an oxide, BaO, SrO, CaO, and Y2O3. There are O5, Gd2O3, Nd2O3, ThO2, ZrO2, Fe2O3, ZnO, CuO, Ag2O, La2O3, PtO, PbO and aluminum 2O3, MgO, In2O3, BiO, NbO, BeO, etc. moreover -- a way ghost -- YB6, GdB6, LaB5, NdB6, CeB6, EuB6, PrB6, and ZrB2 etc. -- it is and there are UC, ZrC, TaC, TiC, NbC, WC, etc. as carbide further Moreover, as an alloy, brass, bronze, phosphor bronze, the alloy (Mg is 2 - 20wt%) of Ag and Mg, the alloy (Be is 1 - 10wt%) of Cu and Be, and the alloy of Ba and aluminum can be used, and an alloy with Above Ag and Mg, the alloy of Cu and Be, and the alloy of Ba and aluminum are desirable An oxide can be obtained also by heating only a surface of metal in air, or oxidizing with a chemical

[0018] As a method of further others, it can heat before use, an oxidizing zone can be formed in a front face, and a stable oxidizing zone can also be obtained over a long period of time. As this example, an oxide film can be made to form the alloy of Mg and Ag in the front face under the 300-400-degree C conditions of temperature in a steam, and this oxidization thin film is stable over a long period of time. Moreover, it can be used, being able to add the matter which emits a photoelectron to another matter. There are some which added the matter which may emit a photoelectron to the diactinism matter as this example (JP,7-93098,B, JP,4-243540,A). There is addition of the unification with the below-mentioned ultraviolet line source, for example, the photoelectric-emission material on the front face of a ultraviolet ray lamp, (JP,4-243540,A). Since it becomes compact by unification, depending on the kind of application box, it is desirable. There is unification with the below-mentioned photocatalyst as other examples (Japanese Patent Application No. No. 132563 [eight to]). By unification, it stabilizes simultaneous removal of the gas-like injurious ingredient which lives together to a particle, and by carrying out self-cleaning of the photoelectric-emission material, and becomes effective by use in a box with much ** gas especially.

[0019] Like the after-mentioned, the configuration and structure of photoelectric-emission material change with

configurations, structures, or effects for which it wishes of equipment (unit) etc., and can be decided suitably. If a photoelectron is emitted by irradiation, any are sufficient as the source of irradiation for the photoelectric emission from photoelectric-emission material, and its ultraviolet rays are usually desirable. As long as photoelectric-emission material emits a photoelectron by the irradiation, any are sufficient as the kind of ultraviolet rays. If this ultraviolet line source emits ultraviolet rays, although either can be used, a mercury-vapor lamp, for example, a germicidal lamp, is desirable in respect of miniaturization. Next, the position and configuration of ultraviolet line source and photoelectric-emission material, electrode, and electric charge particle uptake material ** which are the feature of this invention are described. These surround an ultraviolet line source with the below-mentioned photocatalyst suitably by the military requirement, and are installed, and the feature is to unify as defecation equipment (unit) of the gas containing harmful gas and a particle.

[0020] As long as it can install the position and configuration of photoelectric-emission material so that the ultraviolet rays emitted from an ultraviolet line source may be surrounded (it can do widely like [irradiation area]), any are sufficient as them. Usually, what is necessary is just to be able to install them in a circumferential direction so that these ultraviolet rays may be surrounded since the ultraviolet rays from an ultraviolet line source are emitted to a circumferential direction at a radial. Discharge of the photoelectron from photoelectric-emission material is effective at the UV irradiation under electric field. All can be used for the position and configuration of an electrode for that if electric field (electric field) can be formed between photoelectric-emission material. An electrode material and its structure are easy to be used in the well-known charging equipment. If an electrode material is a conductor, it can use all and has a tungsten, SUS or the line of Cu-Zn, a cylinder, reticulated, and a tabular as this example. these -- one kind -- or it installs so that two or more kinds may be combined and electric field can be formed near the photoelectric-emission material (JP,2-303557,A)

[0021] Although the uptake material (dust collection material) of an electric charge particle has common various usual electrode material, such as dust collection board and collector electrode, and usual electrostatic filter method in a charging equipment, the thing of wool yarn-like structure like a steel wool electrode and a tungsten wool yarn electrode is also effective. Erection REKKU material can also be used suitably. The suitable way of combining of photoelectric-emission material, electrode material, and the uptake material of an electric charge particle can be suitably decided on according to the configuration of a box, structure, a military requirement, economical efficiency, etc., and pollutants, such as a particle which exists in the below-mentioned defecation space section by installation to the space section, just move quickly into this equipment. Photoelectric-emission material, the position of an electrode, and a configuration can be decided by the preliminary test etc. in consideration of [that an ultraviolet line source is surrounded, ultraviolet line source and photoelectric-emission material, an electrode, and electric charge particle uptake material can be unified, and the ultraviolet rays emitted from the ultraviolet line source are used effectively, and the electric charge and the uptake of the particle by discharge of a photoelectron and this photoelectron can be performed effectively] the configuration of a box, an effect, economical efficiency, etc. For example, the amount of photoelectric emission increases, so that the ultraviolet rays of the radial of this circumferential direction are irradiated to photoelectric-emission material as mostly as possible since ultraviolet rays are emitted to a circumferential direction at a radial, when using a rod (cylinder)-like ultraviolet ray lamp.

[0022] Next, the defecation equipment by the photocatalyst is explained. Even if it adheres, as long as a photocatalyst changes the organic nature gas (a nonmethane hydrocarbon, H.C) which removes a gas-like injurious ingredient, is excited by the optical irradiation from the light source, and participates in the increase in a contact angle into the gestalt which does not participate in the increase in a contact angle at decomposition or the stable gestalt which does not do influence, any are sufficient as it. Usually, a semiconductor material is effective, and it can receive easily and is desirable from processability being good. From the field of an effect or economical efficiency, Se, germanium, Si, Ti, Zn, Cu, aluminum, Sn, Ga, In, P, As, Sb, C, Cd, S, Te, nickel, Fe, Co, Ag, Mo, Sr, W, Cr, Ba, Pb, these compounds, an alloy, or an oxide is desirable, and these are independent, and compound and use two or more kinds.

[0023] As an element, as Si, germanium, Se, and a compound, for example, AlP, AlAs, GaP, AlSb, GaAs, InP, GaSb, InAs, InSb, CdS, CdSe, ZnS and MoS₂, WTe₂, Cr₂Te₃, MoTe, Cu₂S, and WS₂, As an oxide, there are TiO₂, Bi₂O₃, CuO, Cu₂O, ZnO and MoO₃, InO₃, Ag₂O, PbO and SrTiO₃, BaTiO₃, Co₃O₄, Fe₂O₃, NiO, etc. Metal material can be calcinated depending on an application place, and a photocatalyst can be formed in a surface of metal. As this example, Ti material is calcinated and it is TiO₂ to the front face. There is a photocatalyst which forms. A photocatalyst surrounds the light source like the aforementioned photoelectric-emission material, and is installed, and the feature is to unify as gaseous defecation equipment (unit). Moreover, it can carry out by uniting with the defecation equipment using the aforementioned photoelectron depending on a military requirement, and is the feature of this invention.

[0024] That is, the installation position in the gas defecation equipment of a photocatalyst has the method of uniting with photoelectric-emission material and installing, and photoelectric-emission material and the method of installing individually. For example, the direct addition to (1) ultraviolet ray lamp and (2) ultraviolet line source are surrounded by the vitrified matter or glass material. Addition on the front face of this vitrified matter, addition on the wall surface of the circumferential direction which counters (3) ultraviolet line source, (4) Or the shape of a tabular, curdy, reticulated, and a honeycomb, a film, the shape of a cylinder, and any fibrous proper material may be coated, or a photocatalyst may be wrapped or put, and you may fix and use into equipment. As an example, there is coating of the titanium dioxide to the glass plate by the sol gel process. Although a photocatalyst can be used also with-like [fine-particles], it can be used by making it a proper configuration by the well-known methods, such as sintering, vacuum evaporation, sputtering, an application, and baking finish.

[0025] These can be suitably chosen according to the configuration of a box, the kind of light source and a configuration, the kind of photocatalyst, the effect for which it wishes, economical efficiency, etc. Moreover, they are Pt, Ag, Pd, RuO₂, and Co₃O₄ to the above-mentioned photocatalyst because of improvement in a photocatalyst operation. It can also be used being able to add the matter [like]. Since a photocatalyst operation is accelerated, addition of this matter is desirable. these -- one kind -- or two or more sets can be doubled and it can use Common knowledge meanses, such as the sinking-in method, a photoreduction method, a spatter vacuum deposition, and the kneading method, can be suitably used for the method of addition. As long as it emits the wavelength which photocatalyst material absorbs as the light source for optical irradiation, any are sufficient, and the light of visible and/or an ultraviolet-rays field is effective, and can use the well-known light source suitably. As an example, there are a germicidal lamp, the black light, a fluorescence chemical lamp, and a UV-B ultraviolet ray lamp as a mercury-vapor lamp.

[0026] Although the light source of the light can be used as removal of a pollutant when removing only a gas-like injurious ingredient, when carrying out by uniting with the equipment by the aforementioned photoelectron, the aforementioned ultraviolet ray lamp, for example, a germicidal lamp, is effective. Since the effective irradiation quantity of light (irradiation which a photocatalyst absorbs and demonstrates a photocatalyst operation) to a photocatalyst can be strengthened and a photocatalyst operation is accelerated, a germicidal lamp is desirable. Although it changes with the kind of thin film of hold objects (a wafer, glass material, etc.) or a hold lifter, and characters when the organic nature gas removal to which a contact angle is made to increase is explained about the removal mechanism of the gas-like injurious ingredient by the photocatalyst, it is thought as follows that it is based on research of this invention persons. That is, that it can say in common by the organic nature gas (H. C) to which the contact angle of the hold object front face in clean room equipment is made to usually increase has main H.C of the amount of macromolecules, and it is having -CO and -COO combination (it having a hydrophilic property) as the structure. This H.C can be considered to be the hydrophobic matter (H. portion of -C-C- of the basic structure of C) which has a hydrophilic part (-CO, -COO bond part).

[0027] If an example explains, the organic nature gas to which the contact angle of hold object front faces, such as a glass substrate in the usual clean room, is made to increase That are amount of macromolecules H.C of C₁₆-C₂₀, for example, a phthalic ester, and a higher-fatty-acid phenol derivative, and it is common for these components as chemical structure - They are CO and the thing for which it has -COO combination (it has a hydrophilic property) (21 air clarification, the 33rd volume, No. 1, p16- 1995). The reasons of these pollution organic nature gas are the plasticizer of a macromolecule product, a release agent, an antioxidant, etc., and the part where a macromolecule product exists is a generation source (21 "air clarification" the 33rd volume, No. 1, p16- 1995). Although the detail of the processing mechanism of these organic nature gas by the photocatalyst is unknown, it can be presumed as follows. That is, when the portions of -CO and -COO combination carry out hydrogen bond of these organic nature gas to OH basis on a wafer or the front face of glass, the upper part serves as a canal side, a wafer and a glass front face become hydrophobic as a result, a contact angle becomes large and membranes are formed on the front face, membranous adhesion force is weak.

[0028] That is, since, as for a photocatalyst, it has an absorption when a photocatalyst is installed in the atmosphere in which organic nature gas exists, -CO and -COO bond part which are the activity section stick to a photocatalyst front face, and receive a photocatalyst operation, and H.C is changed into another stable gestalt. It is thought that a hydrophobic property is not shown as the result even if organic nature gas serves as a stable gestalt (even the low-molecular matter changed), and it does not adhere on a wafer or a glass substrate or it adheres. The photocatalyst is effective also for removal of basic gas (gas-like injurious ingredient) like ammonia or an amine besides decomposition and removal of the aforementioned H.C. According to a military requirement, economical efficiency, etc., the cleaning of the gas in this box is independent. respectively, or what is depended on a photoelectron, and the thing to depend on a photocatalyst can be used for it combining them, and it is the feature of this invention.

[0029] That is, when only a particle (particulate matter) poses a problem, only H.C, NH₃, and a gas-like injurious ingredient like an amine pose a problem in the defecation equipment by the photoelectron and both a particle and a gas-like injurious ingredient pose a problem further in the defecation equipment by the photocatalyst, the defecation equipment which unified the photoelectron and the photocatalyst can be used. In this invention, by installing above defecation equipment (unit) in a box, even if there are raising dust and ** gas in a box, it is removed. That is, this box is a box which has a self-cleaning function. A power unit with a dc-battery loading charge function and the aforementioned defecation equipment are unified, and the box of this invention is attached as a gas defecation unit, and it defecates [it attaches arbitrarily or the unit-like gas defecation equipment using an aforementioned photoelectron and/or an aforementioned photocatalyst with easy removal is unified, it connects with a power supply, and operates and defecates, or] it, and it is the feature of this invention.

[0030] First, the connection between the gas defecation equipment of this invention and a power supply shows the block diagram of the outline to drawing 6, and explains it below. The box 10 of this invention is equipped with the gas defecation equipment A-2 which uses a photoelectron and/or a photocatalyst. Here, the box 10 is united with gas defecation equipment A-2. Although the box of this invention is used for conveyance (carrier) of a substrate In practical use, since there are many ratios of the residence time in a load port, the waiting waiting circle place for a process, and a stocker, gas defecation equipments A-2 other than conveyance are set in addition to conveyance. Cleaning of the gas in a box 10 is carried out in response to supply of the power from the power supply 13 in the power supply 14 installed in this load port, the place of the waiting for a process, and the stocker.

[0031] That is, it defecates the inside of a box by installing the box 10 of this invention where gas defecation equipment A-2

was unified in the load port of a power supply 14, for example, semiconductor processing equipment, the waiting circle place in the waiting for a process, a stocker, etc., carrying out the interval of conveyance like the above, and receiving an electric power supply. the cleaning of the gas using the photoelectron and/or photocatalyst of the above [the inside of a box] by this -- a box -- being waiting (general installation, installation of night, etc.) -- since it is carried out, as for the space in the box where the substrate was contained, clean space is overly created Next, the block diagram of the outline is shown in drawing 7 , and the unification with the gas defecation equipment of this invention and a power unit is explained using it. The box 10 of this invention is equipped with the power unit A-1 with a dc-battery loading charge function, and the gas defecation equipment A-2 which uses a photoelectron and/or a photocatalyst. Here, gas defecation equipment A-2 is unified in this power unit A-1 (a gas defecation unit, A).

[0032] That is, a power unit A-1 changes from the power supply 13 which supplies power to a charging circuit 11, a dc-battery 12, and gas defecation equipment A-2, receives supply of power from a power supply (electric power supply station) 14 suitably, and is charged by the dc-battery 12 through a charging circuit 11. The box of this invention is used for conveyance (carrier), and continuous running of the gas defecation equipment A-2 under conveyance is carried out like the above by the supply from the power supply 13 of the power charged by the dc-battery 12 in this power unit A-1. If it can charge and an electric power supply can be carried out suitably, any are sufficient as a dc-battery 12, for example, it has Li ion cell and a Ni-H battery. The interval of conveyance is installed by the waiting circle place stocker etc. the load boat of a power supply 14, for example, semiconductor processing equipment, and into the waiting for a process, and the box 10 of this invention where the gas defecation unit A was unified is carried out like the above, and receives an electric power supply in a dc-battery 12. the cleaning of the gas using the photoelectron and/or photocatalyst of the above [the inside of a box] by this -- under conveyance of a box and installation -- that is, since it is carried out continuously, clean space is overly maintained in a box

[0033] Next, use of generation of heat from the power unit A-1 which is the feature of this invention is explained. Electronic parts (an example, a power transistor, power FET) with much generation of heat and electronic parts with little generation of heat are in a power unit A-1 by use, in this invention, the heat from electronic parts with much generation of heat is told to the aforementioned gas defecation equipment A-2, and a gaseous flow is promoted. Drawing 8 (a) and (b) explain this. First, drawing 8 (a) is explained. Generation of heat from the electronic parts 15 generated by operation is told to the wall surface 17 of gas defecation equipment A-2 through a heat sink 16. 18 is a ***** sheet for telling this heat efficiently. 18 can use ***** grease and an epoxy resin adhesive in addition to this sheet. Here, if a heat sink 16 is a material which tells heat efficiently, any are sufficient as it, for example, it has Cu and aluminum. Usually, since a weight's being light and cost are comparatively cheap, aluminum is desirable. 19 is electronic parts with little generation of heat installed on the printed-circuit board 20.

[0034] Thus, generation of heat from the electronic parts 15 with much generation of heat is told to the wall surface of gas defecation equipment A-2. Since the circulating load of the gas in this equipment A-2 is accelerated by deployment of this generation of heat, cleaning in a box is carried out effectively. Since the cleaning of the aforementioned gas of this invention is based on the flow of the gas caused by generation of heat from the light sources, such as a ultraviolet ray lamp, although it is essentially loose, since a gaseous flow is accelerated by use of generation of heat from the aforementioned electronic parts, it becomes effective. Next, drawing 8 (b) is explained. Drawing 8 (b) installs a heat sink 16 in the interior of above gas defecation equipment directly through a wall surface 17. In drawing 8 (b), the same sign as drawing 8 (a) expresses the same meaning.

[0035] this invention can be similarly used [be / under / in the usual clean room / air / beginning / it] in / various / a gas, for example, N2 and Ar. Since pure space is continuously obtained by the electric power supply, this box can be used also not only as conveyance but as a stock box (stocker), and is the feature of this invention. By some kind and military requirement of a box, sources of heating, such as a heater and a lamp, can be installed in the interior because of acceleration of a gaseous flow. By this installation, since removal of a pollutant is accelerated, it can use suitably. Being based on a magnet (magnetism) etc. can perform the unification with the box of the gas defecation equipment of this invention, or a gas defecation unit through the packing material of the gas nature from nothing using the well-known junction method.

[0036]

[Example] Next, although an example is shown, this invention is not limited to these examples at all.

The wafer conveyance box 21 in example 1 chip fabrication factory is explained using drawing 1 . Drawing 1 is a horizontal aperture one apparatus conveyance box. In the chip fabrication factory, the product quality in the clean room of a class 1,000 is manufactured. Since a wafer 22 is processed into a quality (detailed-izing, elaboration) product, it is influenced of the gas-like matter or detailed particulate matter (particle) (membrane formation etc.). That is, in addition to introductory H.C from the open air, 1.1-1.5 ppm of nonmethane hydrocarbons of the degasifying reason from a clean room component and instruments exist in the clean room of a class 1,000 as a gas-like injurious ingredient. On the other hand, since there is generating of a pollutant (the gas-like matter, particle) also from an operator, it is dirty environment near the people for a wafer 22.

[0037] For this reason, a wafer 22 is contained by the wafer conveyance box 21, is conveyed in each process (an example, membrane formation process), and is processed to a quality product. After even the box door 23 and a wafer consist of 24 and a sealant 25, and it is unified, and the breaker style of this box 21 makes the box door 23 engage with a door opener (not illustrating standard [for SEMI]) and pulls it out from a box main part horizontally, when it reduces in a lower part line, the

box door 23 is wide opened from the box main part 21. this box 21 -- the automatic carrier robot for clean rooms -- the robot flange 26 -- holding -- the load boat of semiconductor processing equipment -- laying -- after opening of the box door 23 -- a wafer 22 -- the SCARA robot for clean rooms -- every sheet -- loading -- and unloading is carried out. Moreover, after closing the box door 23, it is again conveyed by the automatic carrier robot for clean rooms at the following process processing equipment.

[0038] The gas defecation equipment A-2 which consists of a ultraviolet ray lamp 27, a photocatalyst 28, the photoelectric-emission material 29, the electrode 30 for photoelectric emission from a photoelectric-emission board, and the electric charge particle uptake material 31 is installed in this box 21. The electric power supply from the power supply for the operation of this defecation equipment A-2 is like aforementioned drawing 6, and air clarification in a box 21 is carried out by this equipment A-2. Since this equipment A-2 receives supply of the power from the power supply installed in the load port or the stocker, cleaning is carried out over a long time (pure space is maintained). That is, if it adheres to the hydrocarbon (H. C) and wafer as a gas-like injurious ingredient (harmful gas) adhering to a wafer 22 to which the contact angle of a wafer is made to increase, since an open circuit and a short circuit will be caused in a box 21, a defect is produced in it, and the particle which brings about the fall of the yield exists in it. These pollutants invade in a box 21 from a clean room for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection.

[0039] Here, it is decomposed by the photocatalyst operation by the photocatalyst 28 with which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, and this H.C is changed into the gestalt to which a contact angle is not made to increase. Moreover, the electric charge of the particle (particulate matter) is carried out with the photoelectron 33 emitted from the photoelectric-emission material 29 by which the ultraviolet ray lamp 27 was irradiated, it turns into an electric charge particle, the uptake of this electric charge particle is carried out to an electrode 31 as uptake material of an electric charge particle, and it super-defecates the defecation space section B in which a wafer 22 exists. H.C in a box and movement to the gas defecation equipment A-2 of a particle are based on the flow (inside 34-1 to 34-6 of drawing 1) of the air caused by few temperature gradients of the upper and lower sides in the gas defecation equipment A-2 produced by irradiation of the ultraviolet ray lamp 27 in this equipment A-2. Here, for the product made from P.C., and a ultraviolet ray lamp, a germicidal lamp (254nm) and a photocatalyst are [the quality of the material of a box] TiO₂ to aluminum material. Addition and photoelectric-emission material is [the reticulated SUS (10 V/cm) and electric charge particle uptake material of the electrode for addition and photoelectric emission] SUS material (500 V/cm) about Au at aluminum material.

[0040] 35 in drawing 1 is shading material, and is a **** thing about the irradiation to the wafer 21 of the ultraviolet rays from a ultraviolet ray lamp 27. Moreover, 36 is a diaphragm and is for passing effectively the flow 34-1 to 34-6 of the air by the aforementioned UV irradiation near the wafer. Thus, the harmful gas and the particle in the air in a box 21 are processed, if the air in a box 21 contains substrates, such as a wafer, a contact angle will not increase and overly clarification space will be held rather than a class 1. Since a contact angle does not increase, substrates, such as a wafer, have the effect which adhesion force can form strongly, when membranes are formed on this substrate front face (H. C concentration : 0.1 ppm or less, NH₃ concentration : 1 or less ppb). The defecation space section B of the box where the wafer was contained, and separation are possible for gas defecation equipment A-2, and they are joined through packing material. Separation is performed for the time/year of time [time of scheduled maintenance], every [for example,], respectively. Thereby, maintenance of the container of the defecation space section (B) with which the wafer in a box is contained, and gas defecation equipment (A-2), and management can be performed easily. 37 is kinematic distributor shaft coupling and is the V groove of positioning.

[0041] The wafer conveyance box in example 2 chip fabrication factory is shown in drawing 2. Since the wafer in this works can disregard the influence of the gas-like matter, it performs only particle removal. With the box 21 of drawing 2, gas defecation equipment A-2 is installed, and this equipment A-2 consists of the electrode 30 for the photoelectric emission from a ultraviolet ray lamp 27, the photoelectric-emission material 29, and the photoelectric-emission material 29, and the electric charge particle uptake material 31. Air clarification in a box 21 is carried out like aforementioned drawing 6 by the electric power supply from the power supply installed in the load port and stocker to this gas defecation equipment A-2. That is, if it adheres to a wafer 22, since an open circuit and a short circuit will be caused in a box 21, a defect is produced in it, and the particle which brings about the fall of the yield exists in it. A particle invades in a box 21 from a clean room (class 1,000) for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection.

[0042] Here, the electric charge of the particle is carried out with the photoelectron 33 emitted from the photoelectric-emission material 29 by which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, it turns into an electric charge particle, the uptake of this electric charge particle is carried out to the electric charge particle uptake material 31, and it super-defecates the defecation space section B in which a wafer 22 exists. Since supply of power is received from a power supply as mentioned above, defecation (air clarification) by gas defecation equipment A-2 is carried out over a long time. Thus, super-clarification space purer than a class 1 is maintained in a box 21. In drawing 2, the same sign as drawing 1 shows the same meaning.

[0043] The wafer conveyance box in example 3 chip fabrication factory is shown in drawing 3. At this works, for the use in clean space purer than a class 10, since the influence of a particle can be disregarded, only gas-like injurious-ingredient removal is performed. The gas defecation equipment A-2 of the box 21 of drawing 3 changes with a ultraviolet ray lamp 27 and a photocatalyst 28. Air clarification in a box 21 is carried out like aforementioned drawing 6 by the electric power supply from the power supply installed in the load port and stocker to this gas defecation equipment A-2. Namely, H.C and NH₃ as a

gas-like injurious ingredient (harmful gas) which make the contact angle of a wafer increase to a box 21 when it adheres to a wafer 22. It exists. This harmful gas invades in a box from a clean room for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection. Moreover, depending on the kind of wafer, there is generating (generating of harmful gas) from a wafer front face.

[0044] Here, it is decomposed by the photocatalyst operation by the photocatalyst 28 with which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, these harmful gas is changed into the gestalt to which a contact angle is not made to increase, and it super-defecates the defecation space section B in which a wafer 22 exists. Since supply of power is received from the above power supplies, defecation (air clarification) by gas defecation equipment A-2 is carried out over a long time. With a box 21, even if there is generating of harmful gas from wafer 22 front face, it defecates space in self-cleaning. Thus, the harmful gas in air in a box 21 is processed, and the air in a box 21 will turn into pure air from which the harmful gas which a contact angle does not increase was removed, if substrates, such as a wafer, are contained. (H. C concentration : 0.1 ppm or less, NH₃ concentration : 1 or less ppb). In drawing 3, the same sign as drawing 1 shows the same meaning.

[0045] The box of the wafer conveyance box 21 shown in drawing 1 of example 4 example 1 another type is shown in drawing 4. Drawing 4 is an open cassette receipt type horizontal aperture conveyance box, and contains the open cassette 38 which held the wafer 22 in the box of drawing 1. At breaker guard of this box, since it is held at the open cassette 38, as for a wafer 22, (24 in drawing 1) does not have even a wafer. In drawing 4, the same sign as drawing 1 shows the same meaning.

[0046] The box of the wafer conveyance box shown in drawing 1 of example 5 example 1 another type is shown in drawing 5. Drawing 5 is an open cassette receipt type bottom aperture conveyance box, and a box 21 has the breaker style of the box 21 which changes from the box door 23 and a sealant 25 to the pars basilaris ossis occipitalis. That is, this box 21 is a box of a bottom aperture, the breaker style which consists of the box door 23 of a box 21 and a sealant 25 operates by making an opener with an elevator style (not shown) engaged, and dropping it perpendicularly at the box door 23, and the box door 23 is wide opened from this. The inside of this box 21 contains the open cassette 38 holding the wafer 22. In drawing 5, the same sign as drawing 1 shows the same meaning.

[0047] The wafer conveyance box of composition of having unified the defecation equipment for the harmful gas shown in example 6 drawing 1 and particle removal was installed in the chip fabrication factory of a class 1,000, the following sample gas was put in, UV irradiation was performed, and the contact angle on the wafer contained in the wafer conveyance box and the particle concentration in this box, and nonmethane-hydrocarbon concentration were measured. Here, the electric power supply to a power unit was performed by connecting with the power supply of the stocker in a clean room.

- 1) Size of a conveyance box ; 351, 2 defecation equipment made from P.C. (1) ultraviolet line source ; Germicidal-lamp 4W.
- (2) Photocatalyst material ; On aluminum board, it is TiO₂. It adds by the sol gel process.
- (3) Photoelectric-emission material ; Au is added on aluminum board.
- (4) Electrode for photoelectric emission ; Grid-like SUS material, 20 V/cm.
- (5) Uptake material of an electric charge particle (electrode board) ; An SUS board, 800 V/cm.

[0048] 3) Sample gas (entrance)

Atmosphere : Air, particle concentration : A class 1,000, nonmethane-hydrocarbon concentration : 1.5 ppm four wafers : Measurement of a 12 inch 5 measuring-instrument contact angle ; Measurement of waterdrop formula contact angle meter particle concentration ; Light-scattering formula particle counter (> 0.1 micrometers) Measurement of nonmethane-hydrocarbon concentration ; A gas chromatograph, in addition particle concentration (class) are 1ft3. The total number of the particle 0.1 micrometers or more contained in inside is shown.

[0049] About the contact angle on the wafer contained in the contact angle box on result (1) wafer, a relation with the holding time is shown in drawing 15. In drawing 15, the --- mark shows what has the nothing -**- mark and nothing UV irradiation for what removed the -**- mark and the photocatalyst for what does not set up the electric field for photoelectric emission for the thing of this invention as the -O- mark and comparison.

(2) Particle concentration in a box (class)

The particle concentration (class) in the box of after (1 hour, 2 hours, one day, and one week) is shown in Table 1. As comparison, what does not set up the electric field for photoelectric emission, the thing which removed the photocatalyst, and what has nothing UV irradiation are shown in Table 1.

[0050]

[Table 1]

表 1

数値：クラス

条件	1時間後	2時間後	1日後	1週間後
本発明のもの	<1	<1	<1	<1
光電子放出用の電場を設定しないもの（光触媒のみ）	1000	900	—	—
光触媒を取り外したもの（光電子のみ）	<1	<1	<1	<1
紫外線照射なしのもの	1000	900	—	—

--: -- measurement -- not carrying out -- the nonmethane-hydrocarbon concentration (ppm) in (3) boxes
The above, this time, and the same comparison estimate, and it is shown in Table 2.

[0051]

[Table 2]

表 2

数値：ppm

条件	1時間後	2時間後	1日後	1週間後
本発明のもの	<0.1	<0.1	<0.1	<0.1
光電子放出用の電場を設定しないもの（光触媒のみ）	<0.1	<0.1	<0.1	<0.1
光触媒を取り外したもの（光電子のみ）	1.3	1.2	1.2	1.1
紫外線照射なしのもの	1.4	1.4	1.4	1.3

[0052] In order to check the removal in the space of a nonmethane hydrocarbon also on a wafer, the wafer was contained in the box in the aforementioned conditions, and the phthalic ester on a wafer (DOP, DBP) was investigated.

Measuring method: Desorb the affix on the wafer exposed to the air of the aforementioned conditions for 16 hours, and measure a phthalic ester by the GC/MS method. Consequently, each of what have nothing UV irradiation, and things (only photocatalyst) which removed the photocatalyst detected the phthalic ester. On the other hand, the phthalic ester detected no things of this invention, and things (only photocatalyst) which do not set up the electric field for photoelectric emission.

[0053] The wafer conveyance box 21 in example 7 chip fabrication factory is explained using drawing 9 and drawing 10.

Drawing 9 and 10 are horizontal aperture one apparatus conveyance boxes, and drawing 10 is the side elevation of drawing 9. In the chip fabrication factory, the product quality in the clean room of a class 1,000 is manufactured. Since a wafer 22 is processed into a quality (detailed-izing, elaboration) product, it is influenced of the gas-like matter or detailed particulate matter (particle) (membrane formation etc.). That is, in addition to introductory H.C from the open air, 1.1-1.5 ppm of nonmethane hydrocarbons of the degasifying reason from a clean room component and instruments exist in the clean room of a class 1,000 as a gas-like injurious ingredient. On the other hand, since there is generating of a pollutant (the gas-like matter, particle) also from an operator, it is dirty environment near the people for a wafer 22. For this reason, a wafer 22 is contained by the wafer conveyance box 21, is conveyed in each process (example membrane formation process), and is processed to a quality product.

[0054] After even the box door 23 and a wafer consist of 24 and a sealant 25, and are unified, and the breaker style of this box 21 does not carry out door opener illustration of the box door 23, but makes it engage with a standard [for SEMI] one

and pulling out from a box main part horizontally, the box door 23 is wide opened from the box main part 21 by reducing in a lower part line. this box 21 -- the automatic carrier robot for clean rooms -- the robot flange 26 -- holding -- the load boat of semiconductor processing equipment -- laying -- after opening of the box door 23 -- a wafer 22 -- the SCARA robot for clean rooms -- every sheet -- loading -- and unloading is carried out. Moreover, after closing the box door 23, it is again conveyed by the automatic carrier robot for clean rooms at the following process processing equipment. The gas defecation unit A (A-1+A-2) which changes from the power unit A-1 with a dc-battery 12 loading charge function which supplies power to the gas defecation equipment A-2 which consists of a ultraviolet ray lamp 27, a photocatalyst 28, the photoelectric-emission material 29, the electrode 30 for photoelectric emission from a photoelectric-emission board, and the electric charge particle uptake material 31, and this gas defecation equipment A-2 is installed in this box 21.

[0055] This power unit A-1 and this gas defecation equipment A-2 in this unit A are like aforementioned drawing 7 and 8, and air clarification in a box 21 is carried out by this unit A. Since supply of power is received from the aforementioned power unit A-1, defecation (air clarification) by gas defecation equipment A-2 is continuously carried out over a long time. That is, if it adheres to the hydrocarbon (H. C) and wafer as a gas-like injurious ingredient (harmful gas) adhering to a wafer 22 to which the contact angle of a wafer is made to increase, since an open circuit and a short circuit will be caused in a box 21, a defect is produced in it, and the particle which brings about the fall of the yield exists in it. These pollutants invade in a box 21 from a clean room for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection.

[0056] Here, it is decomposed by the photocatalyst operation by the photocatalyst 28 with which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, and this H.C is changed into the gestalt to which a contact angle is not made to increase. Moreover, the electric charge of the particle (particulate matter) is carried out with the photoelectron 33 emitted from the photoelectric-emission material 29 by which the ultraviolet ray lamp 27 was irradiated, it turns into an electric charge particle, the uptake of this electric charge particle is carried out to an electrode 31 as uptake material of an electric charge particle, and it super-defecates the defecation space section B in which a wafer 22 exists. H.C in a box and movement to the gas defecation equipment A-2 of a particle are based on the flow (inside 34-1 to 34-6 of drawing 9) of the air caused by few temperature gradients of the upper and lower sides in the gas defecation equipment A-2 produced by irradiation of the ultraviolet ray lamp 27 in this equipment A-2, and generation of heat from a power unit A-1. Here, for the product made from P.C., and a ultraviolet ray lamp, a germicidal lamp (254nm) and a photocatalyst are [the quality of the material of a box] TiO₂ to aluminum material. Addition and photoelectric-emission material is [the reticulated SUS (10 V/cm) and electric charge particle uptake material of the electrode for addition and photoelectric emission] SUS material (500 V/cm) about Au at aluminum material.

[0057] 35 in drawing 9 is shading material, and is a **** thing about the irradiation to the wafer 21 of the ultraviolet rays from a ultraviolet ray lamp 27. Moreover, 36 is a diaphragm and is for passing effectively the flow 34-1 to 34-6 of the air by generation of heat from aforementioned UV irradiation and an aforementioned power unit near the wafer. Thus, the harmful gas and the particle in the air in a box 21 are processed, if the air in a box 21 contains substrates, such as a wafer, a contact angle will not increase and overly clarification space will be held rather than a class 1. Since a contact angle does not increase, substrates, such as a wafer, have the effect which adhesion force can form strongly, when membranes are formed on this substrate front face (H. C concentration : 0.1 ppm or less, NH₃ concentration : 1 ppm or less). The defecation space section B of the box where the wafer was contained, and separation are possible for the gas defecation unit A, and they are joined through packing material. Separation is performed for the time/year of time [time of scheduled maintenance], every for example,], respectively. Thereby, the container of the defecation space section (B) in a box, maintenance of a gas defecation unit (A), and management can be performed easily. 37 is kinematic distributor shaft coupling and is the V groove of positioning.

[0058] The wafer conveyance box in example 8 chip fabrication factory is shown in drawing 11. Since the wafer in this works can disregard the influence of the gas-like matter, it performs only particle removal. The gas defecation equipment A-2 in the box 21 of drawing 11 consists of the electrode 30 for the photoelectric emission from a ultraviolet ray lamp 27, the photoelectric-emission material 29, and the photoelectric-emission material 29, and the electric charge particle uptake material 31. Air clarification in a box 21 is carried out from the gas defecation unit A (A-1+A-2) which changes from the dc-battery 12 and the power unit A-1 with a loading charge function which supply power to this gas defecation equipment A-2 and this above gas defecation equipment A-2 like aforementioned drawing 7 and 8.

[0059] That is, if it adheres to a wafer 22, since an open circuit and a short circuit will be caused in a box 21, a defect is produced in it, and the particle which brings about the fall of the yield exists in it. A particle invades in a box 21 from a clean room (class 1,000) for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection. Here, the electric charge of the particle is carried out with the photoelectron 33 emitted from the photoelectric-emission material 29 by which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, it turns into an electric charge particle, the uptake of this electric charge particle is carried out to the electric charge particle uptake material 31, and it super-defecates the defecation space section B in which a wafer 22 exists. Since supply of power is received from the aforementioned power unit A-1, defecation (air clarification) by gas defecation equipment A-2 is continuously performed over a long time. Thus, super-clarification space purer than a class 1 is maintained in a box 21. In drawing 11, drawing 9 and the same sign as 10 show the same meaning.

[0060] The wafer conveyance box in example 9 chip fabrication factory is shown in drawing 12. At this works, for the specification in clean space purer than a class 10, since the influence of a particle can be disregarded, only gas-like

injurious-ingredient removal is performed. The gas defecation equipment A-2 of the box 21 of drawing 12 changes with a ultraviolet ray lamp 27 and a photocatalyst 28. Air clarification in a box 21 is carried out from aforementioned drawing 7 and the gas defecation unit A (A-1+A-2) which changes from the power unit A-1 with a dc-battery loading charge function which supplies power to this gas defecation equipment A-2 and this above gas defecation equipment A-2 like 8. Namely, H.C and NH3 as a gas-like injurious ingredient (harmful gas) which make the contact angle of a wafer increase to a box 21 when it adheres to a wafer 22 It exists. This harmful gas invades in a box from a clean room for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection. Moreover, depending on the kind of wafer, there is generating (generating of harmful gas) from a wafer front face.

[0061] Here, it is decomposed by the photocatalyst operation by the photocatalyst 28 with which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, these harmful gas is changed into the gestalt to which a contact angle is not made to increase, and it super-defecates the defecation space section B in which a wafer 22 exists. Since supply of power is received from the aforementioned power unit A-1, defecation (air clarification) by gas defecation equipment A-2 is continuously carried out over a long time. With a box 21, even if there is generating of harmful gas from wafer 22 front face, it defecates space in self-cleaning. Thus, the harmful gas in air in a box 21 is processed, and the air in a box 21 will turn into pure air from which the harmful gas which a contact angle does not increase was removed, if substrates, such as a wafer, are contained. (H. C concentration : 0.1 ppm or less, NH3 concentration : 1 or less ppb) . In drawing 12 , drawing 9 and the same sign as 10 show the same meaning.

[0062] Drawing 9 of example 10 example 7 and the box of the wafer conveyance box 21 shown in 10 another type are shown in drawing 13 . Drawing 13 is an open cassette receipt type horizontal aperture conveyance box, and contains the open cassette 38 which held the wafer 22 in drawing 9 and the box of 10. At breaker guard of this box, since it is held at the open cassette 38, as for a wafer 22, drawing 9 , and (11, 12) do not have even a wafer. In drawing 13 , drawing 9 and the same sign as 10 show the same meaning.

[0063] Drawing 9 of example 11 example 7 and the box of the wafer conveyance box shown in 10 another type are shown in drawing 14 . Drawing 14 is an open cassette receipt type horizontal aperture conveyance box, and a box 21 has the breaker style of the box 21 which changes from the box door 23 and a sealant 25 to the pars basilaris ossis occipitalis. That is, this box 21 is a box of a bottom aperture, the breaker style which consists of the box door 23 of a box 21 and a sealant 25 operates by making an opener with an elevator style (not shown) engaged, and dropping it perpendicularly at the box door 23, and the box door 23 is wide opened from this. The inside of this box 21 contains the open cassette 38 holding the wafer 22. In drawing 14 , drawing 9 and the same sign as 10 show the same meaning.

[0064] The wafer conveyance box of composition of having been shown in example 12 drawing 9 is installed in the chip fabrication factory of a class 1,000. The gas defecation unit which becomes the defecation equipment for the harmful gas shown in drawing 9 and particle removal, drawing 7 , and this equipment that makes the composition shown in 8 from the power unit with a dc-battery loading charge function for supplying voltage is installed in the interior. The following sample gas was put in, UV irradiation was performed, and the contact angle on the wafer contained in the wafer conveyance box and the particle concentration in this box, and nonmethane-hydrocarbon concentration were measured. Here, the electric power supply to a power unit was performed from the power supply of the stocker in a clean room.

- 1) Size of a conveyance box ; 35L, 2 defecation equipment made from P.C. (1) ultraviolet line source ; Germicidal-lamp 4W.
- (2) Photocatalyst material ; On aluminum board, it is TiO2. It adds by the sol gel process.
- (3) Photoelectric-emission material ; Au is added on aluminum board.
- (4) Electrode for photoelectric emission ; Grid-like SUS material, 20 V/cm.
- (5) Uptake material of an electric charge particle (electrode board) ; An SUS board, 800 V/cm.

[0065] 3) Power unit (1) charging circuit ; What was equipped with the voltage monitor circuit in order to charge a dc-battery by optimum conditions.

- (2) Dc-battery ; Li ion cell.
- (3) Power supply ; Thing equipped with the DC-DC converter and DC-AC converter for supplying the voltage (for germicidal-lamp lighting : AC voltage of 20-50kHz,; for { for photoelectric emission } electrodes DC100 V, for the uptake material of an electric charge particle : DC1,000 V) of a kind required for defecation equipment.
- (4) Electronic parts with much generation of heat used for acceleration of the amount of air circulation : The power transistor and power FET which were used for the DC-DC converter, the DC-AC converter, and the charging circuit.
- (5) Heat sink ; aluminum board (thickness : 2mm).

[0066] 4) Sample gas (entrance)

Atmosphere : Air, particle concentration : A class 1,000, nonmethane-hydrocarbon concentration : 1.5 ppm five wafers ; Measurement of a 12 inch 6 measuring-instrument contact angle ; Measurement of waterdrop formula contact angle meter particle concentration ; Light-scattering formula particle counter (> 0.1 micrometers)

Measurement of nonmethane-hydrocarbon concentration ; A gas chromatograph, in addition particle concentration (class) are 1ft3. The total number of the particle 0.1 micrometers or more contained in inside is shown.

[0067] About the contact angle on the wafer contained in the contact angle box on result (1) wafer, a relation with the holding time is shown in drawing 16 . In drawing 16 , the --- mark shows what has the nothing -**- mark and nothing UV irradiation for what removed the -**- mark and the photocatalyst for what does not set up the electric field for photoelectric emission for the thing of this invention as the -O- mark and comparison.

(2) Particle concentration in a box (class)

The particle concentration (class) in the box of after (1 hour, 2 hours, one day, and one week) is shown in Table 3. As comparison, what does not set up the electric field for photoelectric emission, the thing which removed the photocatalyst, and what has nothing UV irradiation are shown in Table 3.

[0068]

[Table 3]

表 3

数値：クラス

条件	1時間後	2時間後	1日後	1週間後
本発明のもの	<1	<1	<1	<1
光電子放出用の電場を設定しないもの（光触媒のみ）	1000	800	—	—
光触媒を取り外したもの（光電子のみ）	<1	<1	<1	<1
紫外線照射なしのもの	1000	900	—	—

- : Don't Measure but it is Nonmethane-Hydrocarbon Concentration (Ppm) in (3) Boxes.

The above, this time, and the same comparison estimate, and it is shown in Table 4.

[0069]

[Table 4]

表 4

数値：ppm

条件	1時間後	2時間後	1日後	1週間後
本発明のもの	<0.1	<0.1	<0.1	<0.1
光電子放出用の電場を設定しないもの（光触媒のみ）	<0.1	<0.1	<0.1	<0.1
光触媒を取り外したもの（光電子のみ）	1.3	1.2	1.2	1.1
紫外線照射なしのもの	1.4	1.4	1.4	1.3

[0070] In order to check the removal in the space of a nonmethane hydrocarbon also on a wafer, the wafer was contained in the box in the aforementioned conditions, and the phthalic ester on a wafer (DOP, DBP) was investigated.

Measuring method: Desorb the affix on the wafer exposed to the air of the aforementioned conditions for 16 hours, and measure a phthalic ester by the GC/MS method. Consequently, each of what have nothing UV irradiation, and things (only photocatalyst) which removed the photocatalyst detected the phthalic ester. On the other hand, the phthalic ester detected no things of this invention, and things (only photocatalyst) which do not set up the electric field for photoelectric emission. In the thing of this invention in the above, it examined by removing a heat sink. A result is shown in drawing 17. A drawing indicates a relation with the holding time to be nonmethane-hydrocarbon concentration. In drawing 17, the -**- mark shows what removed the heat sink as the -O- mark and comparison for the thing of this invention. From drawing 17, a bird clapper understands the removal speed by this defecation equipment early by installation of a heat sink. ** in drawing 17 shows below limit of detection (0.1 ppm).

[0071]

[Effect of the Invention] According to this invention, the following effects were able to be done so.

1) The gas defecation equipment using the photoelectron and/or photocatalyst for a box having a breaker style and defecating the inside of a box in the conveyance box for semiconductor substrates Or by equipping this equipment with the power unit with a dc-battery loading charge function which supplies power, gas defecation equipment defecated the inside of (1) box, and further, since this cleaning received supply of the power from a power unit, it has been continuously carried out over the long time.

(2) By the breaker style, it became the box which can perform the handling by the robot.

(3) In installation of this gas defecation equipment, unification (simultaneous removal of a particle and gas) of the pure method (only removal of a gas-like injurious ingredient) by the pure method (only removal of a particle) by the photoelectron and the photocatalyst, this photoelectron, and a photocatalyst has been suitably chosen according to the kind of application box, a military requirement, economical efficiency, etc. That is, it became a practically effective pure method and the scope spread.

[0072] (4) The particle in a box (wafer receipt space) and/or the gas-like injurious ingredient were removed effectively. That is, at particle removal, super-clarification space purer than the class 1 which a contact angle does not increase has created simple by space purer than a class 1 and gas-like injurious-ingredient removal by simultaneous removal of the pure space which a contact angle does not increase or these particles, and a gaseous pollutant.

(5) Even when unify the power unit and it does not have it, the residence time of a substrate receipt box has quite much time of places other than conveyances, such as a load port, a stocker, and process waiting, to the time concerning actual conveyance. Therefore, cleaning by the defecation equipment of this invention was rationally carried out over the long time by installing a power supply in places other than conveyance.

[0073] 2) In the cleaning by this gas defecation equipment in the above 1, by telling generation of heat in this power unit to gas defecation equipment, the flow of the gas in a box was accelerated and removal of the pollutant by the photoelectron and/or the photocatalyst became effective.

3) Since it was detachable with the defecation space section of (1) box when the gas defecation equipment in the above 1 is unified and it was made to be possible [removal] from the box, maintenance of the defecation space section or this unit and management became easy.

(2) It could attach not only in the box of this invention but in other proper boxes, and the scope spread.

[0074] 4) ** gas, raising dust, and ** gas and raising dust from box material from that the invasion pollutant into the box accompanying receipt and taking out of (1) substrate is natural and a substrate front face were also removed, and the above super-defecated the inside of a box in self-cleaning.

(2) As a box material, the plastic material by which we are anxious about ** gas can be used. Since plastics was light, it became practically effective.

(3) cleaning carries out continuously in response to supply of the power from a power unit -- having (pure space overly being maintained) -- it can be suitably used also as a stock box (stocker)

(4) Since it became a practically effective box, it could be used for the conveyance box of the substrate in a latus field.

(5) The scope spread and practicality improved.

(6) Although the substrate size also enlarges the semiconductor simultaneously [quality improvement, detailed-izing, and elaboration] with ***** and use of a robot or a substrate receipt box will become indispensable from now on, it can be suitably used as a substrate receipt box (conveyance, for a stock) in such a process.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the conveyance box for semiconductor substrates, especially relates to the conveyance box (carrier box) which contains and conveys substrates, such as Si wafer in frontier industries, such as a semiconductor, liquid crystal, and the precision machinery industry, a glass substrate, and a metallic-coating substrate.

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PRIOR ART

[Description of the Prior Art] Drawing 18 is used and air clarification [in / a semiconductor plant / for air clarification in the conventional clean room] is explained to an example. In drawing 18 , coarse grain is first removed by the pre-filter 2, subsequently the open air 1 is air-conditioned with the air-conditioning machine 3, and dust removing is carried out with the neutral ability filter 4. Next, a detailed particle is removed by the high efficiency particulate air filter (high efficiency filter) 6 currently installed in the ceiling section of a clean room 5, and, as for a clean room 5, classes 100-1,000 are maintained ("washing design" p.11-24, Summer1988). 7-1 and 7-2 show a fan, and an arrow shows the flow of air. Since it aimed at particle removal, air clarification in the conventional clean room was constituted like drawing 18 . With such composition, although it is effective for particle removal, there is no effect in removal of a gas-like injurious ingredient.

[0003] On the other hand, in the clean room of a large room method like drawing 18 , the technical problem that cost overly starts too much to clean-izing occurs (41 BREAK THROUGH and No. 5 p.38- 1993). By the way, in addition to that a particle's (particulate matter) quality improvement of a product and precise-izing are natural in connection with a **** lead and this, and a particle, by semiconductor industry, the gas-like matter will involve as a contamination from now on. That is, it becomes important [control of the gas-like matter (gas-like injurious ingredient)] conventionally that just particle removal was enough as from now on. Since it will be introduced into a clean room, without removing only a particle but removing the gas-like injurious ingredient from the open air with the filter of the conventional clean room which this showed to aforementioned drawing 18 , it is because it becomes a problem.

[0004] namely, a clean room -- setting -- a particle (particulate matter) and an old dust filter (an example --) In HEPA and a ULPA filter, a uptake, the exhaust gas of the automobile which will not be removed but will be introduced in a clean room, Gas-like matter, such as organic nature gas called hydrocarbon (H. C.) which originates in degasifying etc. from the macromolecule resin product currently widely used as a consumer product, and NH3, basic (alkalinity) gas like an amine, poses a problem as a gas-like injurious ingredient. Among this, since the thing of the super-low concentration in usual air (indoor air and open air) brings about contamination as a gas-like injurious ingredient, it is necessary to remove H.C.

Moreover, recently, degasifying from the macromolecule resins of the component of a clean room or a use instrument (an example, wafer receipt box) poses a problem as an H.C. generation source (49 Japan Machinery Federation, the report in the Heisei 6 fiscal year, March, Heisei 7, p.41- 1995).

[0005] What was generated in the work [these gas-like matter] in a clean room poses a problem. That is, since the gas-like matter generated in the aforementioned clean room to the gas-like matter (the gas-like matter in the open air will be introduced with the filter in a clean room since the gas-like matter is unremovable) introduced from the open air in the usual clean room is added as a reason of this gas-like matter, compared with the open air, the gas-like matter in a clean room serves as high concentration, and pollutes a wafer base material and a substrate. That is, if the above-mentioned pollutant (a particle, gas-like injurious ingredient) adheres to the substrate front face of a wafer, half-finished products, and a product, a particle will cause an open circuit and short circuit of the circuit on the front face of a substrate (pattern), and will produce a defect. Moreover, as gas-like matter, if ** H.C. adheres to a wafer (substrate) front face, the increase in a contact angle will be brought about and H.C. will affect the compatibility (concordance) of a substrate and a resist. And if compatibility becomes bad, it will have a bad influence on the thickness of a resist, or it has a bad influence on the adhesion of a substrate and a resist (21 air clarification, the 33rd volume, No. 1, p.16- 1995). Moreover, H.C. causes proof-pressure degradation (fall of reliability) of the oxide film of a wafer (686 the collection of the 39th applied-physics relation union lecture meeting drafts, p. 1992).

[0006] ** NH3 generation of an ammonium salt etc. -- bringing -- a wafer -- becoming cloudy (resolving being poor) -- it causes (25 p.15- a rear rice company, the latest technical lecture, the collection of data, a semiconductor process seminar, October 29, 1996, 1996) According to such a cause, not only these gaseous pollutants but also the productivity (yield) of a semiconductor product reduce a particle. Since especially the above-mentioned gas-like matter as a gas-like injurious ingredient makes [many] circulation of clean room air and is used in the viewpoint of energy saving according to an above-mentioned generating reason recently again, the concentration of the gas-like matter in a clean room is condensed, is remarkable high concentration compared with the open air, adheres to a base material or a substrate, and pollutes this front face. When the grade of this contamination can be expressed with the contact angle of a base material or a substrate and is intense, its contact angle is large. [of contamination] Even if it forms membranes on the front face, a membranous bond strength imitates the fall of the yield weakly (concordance is bad), and the base material and the substrate with a large contact

angle are **.

[0007] Here, a contact angle is a contact angle of the wetting by water, and the grade of contamination on the front face of a substrate is shown. That is, if the pollutant of a hydrophobic property (oiliness) adheres to a substrate front face, the front face will crawl water again and will stop being able to wet wet easily. Then, the contact angle of a substrate front face and waterdrop becomes large. Therefore, when a degree of contamination is high when a contact angle is large, and a contact angle is conversely small, a degree of contamination is a low. In order to carry out the cyclic use of waste water of the air of a clean room in respect of energy saving especially recently, the gas-like injurious ingredient in a clean room will increase gradually, and will pollute a base material and a substrate.

[0008] It considers as the cure which carries out the pollution control of the substrate from such a pollutant, and conveyance by (1) robot is effective. That is, since people are raising dust and a source of ** gas, it is important for them to lose people's mediation for air-cleanliness-class maintenance (116 monthly Semiconductor world, the January issue, p.112- 1997). (2) Moreover, in respect of clean-izing, it is proposed that clean-izing of future space has the effective formation (mini en BAIROMENTO) of partial clean which limits pure space (localization) (378 ** NIKKEI MICRODEVICES, the July issue, p.136- 141, 1995, ** Proceedings of IES, p.373- 1994). Although the method which contains Si wafer in the box made of synthetic resin (plastics), and conveys it as such mini en BAIROMENTO now is examined (1) (2) to which particle contamination becomes serious on the contrary when raising dust breaks out suddenly from the interior The cure to degasifying (shot gas) from box material is the need and (3). By (1) and (2) since the process which carries out routine cleaning of the box itself increases, it becomes complicated and is a problem practically -- etc. -- there is indication (10 a KANOMAX aerosol seminar, p.1- 1996) Being in such inside, this invention persons have proposed the clean-ized method of the space which uses a photoelectron and a photocatalyst as partial clean-ized technology.

[0009] for example, -- 1 it is based on a photoelectron -- pure -- method (removal of particulate matter):JP,3-5859,B. JP,6-74909,B, JP,8-211,B, JP,7-121367,B, and 2 it is based on a photocatalyst -- pure -- method (removal of gas-like injurious ingredient):JP,9-168722,A, JP,9-205046,A, and 3 combined use method [of a photoelectron and a photocatalyst] (simultaneous removal of particle and gas): -- there is JP,1-266864,A Depending on an application place (kind of equipment), or a military requirement, by the aforementioned pure method, although these pure methods were effective, they need to improve the usage suitably depending on an application place or a military requirement. In this improvement, there was a problem of improving so that it may become practically much more effective. As one of the problem of the, these aforementioned pure methods make a gas fluidize by generation of heat by the light sources, such as ultraviolet rays, and are performing cleaning. That is, it was important how this gas is effectively fluidized depending on the application place of the aforementioned pure method, and it was the problem which should improve.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, the following effects were able to be done so.

1) In the conveyance box for semiconductor substrates, a box has a breaker style. By equipping the photoelectron and/or the gas defecation equipment using a photocatalyst, or this equipment for defecating the inside of a box with the power unit with a dc-battery loading charge function which supplies power, gas defecation equipment defecated the inside of (1) box, and further, since this cleaning received supply of the power from a power unit, it has been continuously carried out over the long time.

(2) By the breaker style, it became the box which can perform the handling by the robot.

(3) In installation of this gas defecation equipment, unification (simultaneous removal of a particle and gas) of the pure method (only removal of a gas-like injurious ingredient) by the pure method (only removal of a particle) by the photoelectron and the photocatalyst, this photoelectron, and a photocatalyst has been suitably chosen according to the kind of application box, a military requirement, economical efficiency, etc. That is, it became a practically effective pure method and the scope spread.

[0072] (4) The particle in a box (wafer receipt space) and/or the gas-like injurious ingredient were removed effectively. That is, at particle removal, super-clarification space purer than the class 1 which a contact angle does not increase has created simple by space purer than a class 1 and gas-like injurious-ingredient removal by simultaneous removal of the pure space which a contact angle does not increase or these particles, and a gaseous pollutant.

(5) Even when unify the power unit and it does not have it, the residence time of a substrate receipt box has quite much time of places other than conveyances, such as a load port, a stocker, and process waiting, to the time concerning actual conveyance. Therefore, cleaning by the defecation equipment of this invention was rationally carried out over the long time by installing a power supply in places other than conveyance.

[0073] 2) In the cleaning by this gas defecation equipment in the above 1, by telling generation of heat in this power unit to gas defecation equipment, the flow of the gas in a box was accelerated and removal of the pollutant by the photoelectron and/or the photocatalyst became effective.

3) Since it was detachable with the defecation space section of (1) box when the gas defecation equipment in the above 1 is unified and it was made to be possible [removal] from the box, maintenance of the defecation space section or this unit and management became easy.

(2) It could attach not only in the box of this invention but in other proper boxes, and the scope spread.

[0074] 4) ** gas, raising dust, and ** gas and raising dust from box material from that the invasion pollutant into the box accompanying receipt and taking out of (1) substrate is natural and a substrate front face were also removed, and the above super-defecated the inside of a box in self-cleaning.

(2) As a box material, the plastic material by which we are anxious about ** gas can be used. Since plastics was light, it became practically effective.

(3) cleaning carries out continuously in response to supply of the power from a power unit -- having (pure space overly being maintained) -- it can be suitably used also as a stock box (stocker)

(4) Since it became a practically effective box, it could be used for the conveyance box of the substrate in a large field.

(5) The scope spread and practicality improved.

(6) Simultaneously [quality improvement, detailed-izing, and precise-izing] with ****, a semiconductor can also use the substrate size suitably as a substrate receipt box (conveyance, for a stock) in such a process from now on, although it enlarges and use of a robot or a substrate receipt box becomes indispensable.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Then, this invention makes it a technical problem to offer the conveyance box for semiconductor substrates which has the removal function of a particle practically effective as a conveyance box for semiconductor substrates of mini en BAIROMENTO where a request is increasing, and/or a gas-like injurious ingredient in view of the above-mentioned conventional technology as quality improvement of a product, precise-izing, and detailed-ization progress in frontier industries, such as a semiconductor, liquid crystal, and the precision machinery industry.

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MEANS

[Means for Solving the Problem] conveyance box **** for semiconductor substrates which has the breaker style which can go a semiconductor substrate in and out in this invention in order to solve the above-mentioned technical problem -- it considers as the conveyance box for semiconductor substrates characterized by having the gas defecation unit which united the gas defecation equipment using the photoelectron and/or photocatalyst by optical irradiation for defecating the inside of a box with this box Moreover, in this invention, it considers as the conveyance box for semiconductor substrates characterized by to have the gas defecation unit which unified the gas defecation equipment using the photoelectron and/or the photocatalyst by optical irradiation for defecating the inside of a box, and the power unit with a dc-battery loading charge function which supplies power to this equipment in this box in the conveyance box for semiconductor substrates which has the breaker style which can go a semiconductor substrate in and out.

[0012] As for the aforementioned conveyance box, it is good to make material into synthetic resin, and when a power unit is unified, as for the aforementioned gas defecation unit, it is good to have a radiator for telling generation of heat in a power unit to gas defecation equipment. Moreover, when the aforementioned gas defecation unit is not unifying the power unit, in response to an electric power supply, it operates by connection with the power supply installed in the load port, the waiting circle place in the waiting for a process, the stocker, etc. in the intervals of conveyance of this conveyance box (at the times other than conveyance).

[0013]

[Embodiments of the Invention] The conveyance box for semiconductor substrates of this invention has the breaker style to which a semiconductor substrate can be gone receipt and for taking out in and out in a box, the gas defecation equipment (gas defecation unit) using the photoelectron and/or photocatalyst by optical irradiation for defecating the inside of a box is unified, and this unit can be suitably removed from a box. By connection with the power supply installed in the load port, the waiting circle place in the waiting for a process, the stocker, etc. in the intervals of use of original as conveyance of a box (between other than conveyance), an electric power supply is received, it operates, and, as for the aforementioned gas defecation equipment, cleaning of the gas in the box where the substrate was contained by this is performed. Moreover, the conveyance box for semiconductor substrates of this invention The gas defecation equipment using the photoelectron and/or photocatalyst by optical irradiation for having the breaker style to which a semiconductor substrate can be gone receipt and for taking out in and out in a box, and defecating the inside of a box, It has a power unit with a dc-battery loading charge function for supplying power to this equipment, they are unified (gas defecation unit), and this unit can be suitably removed from a box.

[0014] Furthermore, this unit can be equipped with the radiator which tells generation of heat from a power unit to the gas defecation equipment which uses a photoelectron and/or a photocatalyst. The box of these this inventions may contain a semiconductor substrate, and can convey and/or keep it, and any are sufficient as it as long as it is the container which can be sealed. For example, there are metal and a product made of synthetic resin. The product made from aluminum is desirable at the lightweight point in the thing made from this money-paid-on-account group. Moreover, in the case of synthetic resin, although it may excel in processability, rigidity, and endurance, and any are sufficient as long as ** gas is a few material, if it is the thing of transparency, in addition, it is desirable. For example, there are engineering plastics, such as general-purpose plastics, such as ABS and an acrylic, and a polycarbonate (P. C.), and super engineering plastics which are polyether imide etc. further.

[0015] The breaker style of a box may be the aforementioned box in which the gas defecation equipment using the below-mentioned photoelectron and/or below-mentioned photocatalyst of this invention can be installed and which can be sealed, and any are sufficient as it as long as receipt and ejection can do a substrate suitably. For example, the breaker style of a box consists of a box door, a wafer presser foot, and a sealant, it is unified, and after making a box door engage with a door opener (standard [for SEMI]) and pulling out from a box main part horizontally, a box door is wide opened from a box main part by reducing in a lower part line. As an example of such a box, it is the position of an opening-and-closing door, and the receipt gestalt (is a substrate contained to an oven cassette or not?) of a substrate to 1. A horizontal aperture one apparatus conveyance box and 2 An open cassette receipt type horizontal aperture conveyance box and 3 There is an oven cassette receipt type bottom aperture conveyance box.

[0016] Next, the gas defecation equipment by the photoelectron and/or photocatalyst which can do removal suitably is stated to the box which has the aforementioned breaker style which is the feature of this invention. The flow (natural circulation) of the gas using generation of heat within equipment [pollutant / in a box] removes this equipment effectively by installing in

the one section in a box. First, the composition is explained below about the defecation equipment by the photoelectron. The defecation equipment by the photoelectron is the electrode material for electric fields for photoelectric-emission material, a ultraviolet ray lamp, and photoelectric emission, electric charge particle uptake material, and a thing that is constituted more and removes a particle. If a photoelectron is emitted by irradiation of ultraviolet rays, any are sufficient as photoelectric-emission material, and its photoelectricity-work function is [a smaller thing] more desirable. From the field of an effect or economical efficiency Ba, Sr, calcium, Y, Gd, La, Ce, Nd, Th, Pr, Be, Zr, Fe, nickel, Zn, Cu, Ag, Pt, Cd, Pb, aluminum, C, Mg, Au, In, Bi, Nb, Si, Ti, Ta, U, B, Eu, Sn, P, or W Or these compounds, an alloy, or mixture is desirable, and these are independent, or two or more sorts are compounded and it is used. As a composite, a physical composite can also be used like amalgam.

[0017] For example, there are an oxide, a way ghost, and carbide as a compound. To an oxide, BaO, SrO, CaO, and Y₂O₃, Gd₂O₃, Nd₂O₃, ThO₂, ZrO₂, Fe₂O₃, ZnO, CuO, Ag₂O, La₂O₃, PtO, PbO and aluminum₂O₃, MgO, In₂O₃, BiO, NbO, BeO, etc. moreover -- a way ghost -- YB₆, GdB₆, LaB₅, NdB₆, CeB₆, EuB₆, PrB₆, and ZrB₂ etc. -- it is and there are UC, ZrC, TaC, TiC, NbC, WC, etc. as carbide further Moreover, as an alloy, brass, bronze, phosphor bronze, the alloy (Mg is 2 - 20wt%) of Ag and Mg, the alloy (Be is 1 - 10wt%) of Cu and Be, and the alloy of Ba and aluminum can be used, and an alloy with Above Ag and Mg, the alloy of Cu and Be, and the alloy of Ba and aluminum are desirable. An oxide can be obtained also by heating only a surface of metal in air, or oxidizing with a chemical.

[0018] As a method of further others, it can heat before use, an oxidizing zone can be formed in a front face, and a stable oxidizing zone can also be obtained over a long period of time. As this example, an oxide film can be made to form the alloy of Mg and Ag in the front face under the 300-400-degree C conditions of temperature in a steam, and this oxidization thin film is stable over a long period of time. Moreover, it can be used, being able to add the matter which emits a photoelectron to another matter. There are some which added the matter which may emit a photoelectron to the diactinism matter as this example (JP,7-93098,B, JP,4-243540,A). There is addition of the unification with the below-mentioned ultraviolet line source, for example, the photoelectric-emission material on the front face of a ultraviolet ray lamp, (JP,4-243540,A). Since it becomes compact by unification, depending on the kind of application box, it is desirable. There is unification with the below-mentioned photocatalyst as other examples (Japanese Patent Application No. No. 132563 [eight to]). By unification, it stabilizes simultaneous removal of the gas-like injurious ingredient which lives together to a particle, and by carrying out self-cleaning of the photoelectric-emission material, and becomes effective by use in a box with much ** gas especially.

[0019] Like the after-mentioned, the configuration and structure of photoelectric-emission material change with configurations, structures, or effects for which it wishes of equipment (unit) etc., and can be decided suitably. If a photoelectron is emitted by irradiation, any are sufficient as the source of irradiation for the photoelectric emission from photoelectric-emission material, and its ultraviolet rays are usually desirable. As long as photoelectric-emission material emits a photoelectron by the irradiation, any are sufficient as the kind of ultraviolet rays. If this ultraviolet line source emits ultraviolet rays, although either can be used, a mercury-vapor lamp, for example, a germicidal lamp, is desirable in respect of miniaturization. Next, the position and configuration of ultraviolet line source and photoelectric-emission material, electrode, and electric charge particle uptake material ** which are the feature of this invention are described. These surround an ultraviolet line source with the below-mentioned photocatalyst suitably by the military requirement, and are installed, and the feature is to unify as defecation equipment (unit) of the gas containing harmful gas and a particle.

[0020] As long as it can install the position and configuration of photoelectric-emission material so that the ultraviolet rays emitted from an ultraviolet line source may be surrounded (it can do widely like [irradiation area]), any are sufficient as them. Usually, what is necessary is just to be able to install them in a circumferential direction so that these ultraviolet rays may be surrounded since the ultraviolet rays from an ultraviolet line source are emitted to a circumferential direction at a radial. Discharge of the photoelectron from photoelectric-emission material is effective at the UV irradiation under electric field. All can be used for the position and configuration of an electrode for that if electric field (electric field) can be formed between photoelectric-emission material. An electrode material and its structure are easy to be used in the well-known charging equipment. If an electrode material is a conductor, it can use all and has a tungsten, SUS or the line of Cu-Zn, a cylinder, reticulated, and a tabular as this example. these -- one kind -- or it installs so that two or more kinds may be combined and electric field can be formed near the photoelectric-emission material (JP,2-303557,A)

[0021] Although the uptake material (dust collection material) of an electric charge particle has common various usual electrode material, such as dust collection board and collector electrode, and usual electrostatic filter method in a charging equipment, the thing of wool yarn-like structure like a steel wool electrode and a tungsten wool yarn electrode is also effective. Erection REKKU material can also be used suitably. The suitable way of combining of photoelectric-emission material, electrode material, and the uptake material of an electric charge particle can be suitably decided on according to the configuration of a box, structure, a military requirement, economical efficiency, etc., and pollutants, such as a particle which exists in the below-mentioned defecation space section by installation to the space section, just move quickly into this equipment. Photoelectric-emission material, the position of an electrode, and a configuration can be decided by the preliminary test etc. in consideration of [that an ultraviolet line source is surrounded, ultraviolet line source and photoelectric-emission material, an electrode, and electric charge particle uptake material can be unified, and the ultraviolet rays emitted from the ultraviolet line source are used effectively, and the electric charge and the uptake of the particle by discharge of a photoelectron and this photoelectron can be performed effectively] the configuration of a box, an effect, economical efficiency, etc. For example, the amount of photoelectric emission increases, so that the ultraviolet rays of the

radial of this circumferencial direction are irradiated to photoelectric-emission material as mostly as possible since ultraviolet rays are emitted to a circumferencial direction at a radial, when using a rod (cylinder)-like ultraviolet ray lamp.

[0022] Next, the defecation equipment by the photocatalyst is explained. Even if it adheres, as long as a photocatalyst changes the organic nature gas (a nonmethane hydrocarbon, H.C) which removes a gas-like injurious ingredient, is excited by the optical irradiation from the light source, and participates in the increase in a contact angle into the gestalt which does not participate in the increase in a contact angle at decomposition or the stable gestalt which does not do influence, any are sufficient as it. Usually, a semiconductor material is effective, and it can receive easily and is desirable from processability being good. From the field of an effect or economical efficiency, Se, germanium, Si, Ti, Zn, Cu, aluminum, Sn, Ga, In, P, As, Sb, C, Cd, S, Te, nickel, Fe, Co, Ag, Mo, Sr, W, Cr, Ba, Pb, these compounds, an alloy, or an oxide is desirable, and these are independent, and compound and use two or more kinds.

[0023] As an element, as Si, germanium, Se, and a compound, for example, AlP, AlAs, GaP, AlSb, GaAs, InP, GaSb, InAs, InSb, CdS, CdSe, ZnS and MoS₂, WTe₂, Cr₂Te₃, MoTe, Cu₂S, and WS₂. As an oxide, there are TiO₂, Bi₂O₃, CuO, Cu₂O, ZnO and MoO₃, InO₃, Ag₂O, PbO and SrTiO₃, BaTiO₃, Co₃O₄, Fe₂O₃, NiO, etc. Metal material can be calcinated depending on an application place, and a photocatalyst can be formed in a surface of metal. As this example, Ti material is calcinated and it is TiO₂ to the front face. There is a photocatalyst which forms. A photocatalyst surrounds the light source like the aforementioned photoelectric-emission material, and is installed, and the feature is to unify as gaseous defecation equipment (unit). Moreover, it can carry out by uniting with the defecation equipment using the aforementioned photoelectron depending on a military requirement, and is the feature of this invention.

[0024] That is, the installation position in the gas defecation equipment of a photocatalyst has the method of uniting with photoelectric-emission material and installing, and photoelectric-emission material and the method of installing individually. For example, the direct addition to (1) ultraviolet ray lamp and (2) ultraviolet line source are surrounded by the vitrified matter or glass material. Addition on the front face of this vitrified matter, addition on the wall surface of the circumferencial direction which counters (3) ultraviolet line source, (4) Or the shape of a tabular, curdy, reticulated, and a honeycomb, a film, the shape of a cylinder, and any fibrous proper material may be coated, or a photocatalyst may be wrapped or put, and you may fix and use into equipment. As an example, there is coating of the titanium dioxide to the glass plate by the sol gel process. Although a photocatalyst can be used also with-like [fine-particles], it can be used by making it a proper configuration by the well-known methods, such as sintering, vacuum evaporationo, sputtering, an application, and baking finish.

[0025] These can be suitably chosen according to the configuration of a box, the kind of light source and a configuration, the kind of photocatalyst, the effect for which it wishes, economical efficiency, etc. Moreover, they are Pt, Ag, Pd, RuO₂, and Co₃O₄ to the above-mentioned photocatalyst because of improvement in a photocatalyst operation. It can also be used being able to add the matter [like]. Since a photocatalyst operation is accelerated, addition of this matter is desirable. these -- one kind -- or two or more sets can be doubled and it can use Common knowledge meansas, such as the sinking-in method, a photoreduction method, a spatter vacuum deposition, and the kneading method, can be suitably used for the method of addition. As long as it emits the wavelength which photocatalyst material absorbs as the light source for optical irradiation, any are sufficient, and the light of visible and/or an ultraviolet-rays field is effective, and can use the well-known light source suitably. As an example, there are a germicidal lamp, the black light, a fluorescence chemical lamp, and a UV-B ultraviolet ray lamp as a mercury-vapor lamp.

[0026] Although the light source of the light can be used as removal of a pollutant when removing only a gas-like injurious ingredient, when carrying out by uniting with the equipment by the aforementioned photoelectron, the aforementioned ultraviolet ray lamp, for example, a germicidal lamp, is effective. Since the effective irradiation quantity of light (irradiation which a photocatalyst absorbs and demonstrates a photocatalyst operation) to a photocatalyst can be strengthened and a photocatalyst operation is accelerated, a germicidal lamp is desirable. Although it changes with the kind of thin film of hold objects (a wafer, glass material, etc.) or a hold lifter, and characters when the organic nature gas removal to which a contact angle is made to increase is explained about the removal mechanism of the gas-like injurious ingredient by the photocatalyst, it is thought as follows that it is based on research of this invention persons. That is, that it can say in common by the organic nature gas (H. C) to which the contact angle of the hold object front face in clean room equipment is made to usually increase has main H.C of the amount of macromolecules, and it is having -CO and -COO combination (it having a hydrophilic property) as the structure. This H.C can be considered to be the hydrophobic matter (H. portion of -C-C- of the basic structure of C) which has a hydrophilic part (-CO, -COO bond part).

[0027] If an example explains, the organic nature gas to which the contact angle of hold object front faces, such as a glass substrate in the usual clean room, is made to increase That are amount of macromolecules H.C of C₁₆-C₂₀, for example, a phthalic ester, and a higher-fatty-acid phenol derivative, and it is common for these components as chemical structure - They are CO and the thing for which it has -COO combination (it has a hydrophilic property) (21 air clarification, the 33rd volume, No. 1, p16- 1995). The reasons of these pollution organic nature gas are the plasticizer of a macromolecule product, a release agent, an antioxidant, etc., and the part where a macromolecule product exists is a generation source (21 "air clarification" the 33rd volume, No. 1, p16- 1995). Although the detail of the processing mechanism of these organic nature gas by the photocatalyst is unknown, it can be presumed as follows. That is, when the portions of -CO and -COO combination carry out hydrogen bond of these organic nature gas to OH basis on a wafer or the front face of glass, the upper part serves as a canal side, a wafer and a glass front face become hydrophobic as a result, a contact angle becomes large and membranes are formed

on the front face, membranous adhesion force is weak.

[0028] That is, since, as for a photocatalyst, it has an absorption when a photocatalyst is installed in the atmosphere in which organic nature gas exists, -CO and -COO bond part which are the activity section stick to a photocatalyst front face, and receive a photocatalyst operation, and H.C is changed into another stable gestalt. It is thought that a hydrophobic property is not shown as the result even if organic nature gas serves as a stable gestalt (even the low-molecular matter changed), and it does not adhere on a wafer or a glass substrate or it adheres. The photocatalyst is effective also for removal of basic gas (gas-like injurious ingredient) like ammonia or an amine besides decomposition and removal of the aforementioned H.C. According to a military requirement, economical efficiency, etc., the cleaning of the gas in this box is independent, respectively, or what is depended on a photoelectron, and the thing to depend on a photocatalyst can be used for it combining them, and it is the feature of this invention.

[0029] That is, when only a particle (particulate matter) poses a problem, only H.C, NH3, and a gas-like injurious ingredient like an amine pose a problem in the defecation equipment by the photoelectron and both a particle and a gas-like injurious ingredient pose a problem further in the defecation equipment by the photocatalyst, the defecation equipment which unified the photoelectron and the photocatalyst can be used. In this invention, by installing above defecation equipment (unit) in a box, even if there are raising dust and ** gas in a box, it is removed. That is, this box is a box which has a self-cleaning function. A power unit with a dc-battery loading charge function and the aforementioned defecation equipment are unified, and the box of this invention is attached as a gas defecation unit, and it defecates [it attaches arbitrarily or the unit-like gas defecation equipment using an aforementioned photoelectron and/or an aforementioned photocatalyst with easy removal is unified, it connects with a power supply, and operates and defecates, or] it, and it is the feature of this invention.

[0030] First, the connection between the gas defecation equipment of this invention and a power supply shows the block diagram of the outline to drawing 6, and explains it below. The box 10 of this invention is equipped with the gas defecation equipment A-2 which uses a photoelectron and/or a photocatalyst. Here, the box 10 is united with gas defecation equipment A-2. Although the box of this invention is used for conveyance (carrier) of a substrate In practical use, since there are many ratios of the residence time in a load port, the waiting waiting circle place for a process, and a stocker, gas defecation equipments A-2 other than conveyance are set in addition to conveyance. Cleaning of the gas in a box 10 is carried out in response to supply of the power from the power supply 13 in the power supply 14 installed in this load port. the place of the waiting for a process, and the stocker.

[0031] That is, it defecates the inside of a box by installing the box 10 of this invention where gas defecation equipment A-2 was unified in the load port of a power supply 14, for example, semiconductor processing equipment, the waiting circle place in the waiting for a process, a stocker, etc., carrying out the interval of conveyance like the above, and receiving an electric power supply. the cleaning of the gas using the photoelectron and/or photocatalyst of the above [the inside of a box] by this -- a box -- being waiting (general installation, installation of night, etc.) -- since it is carried out, as for the space in the box where the substrate was contained, clean space is overly created Next, the block diagram of the outline is shown in drawing 7, and the unification with the gas defecation equipment of this invention and a power unit is explained using it. The box 10 of this invention is equipped with the power unit A-1 with a dc-battery loading charge function, and the gas defecation equipment A-2 which uses a photoelectron and/or a photocatalyst. Here, gas defecation equipment A-2 is unified in this power unit A-1 (a gas defecation unit, A).

[0032] That is, a power unit A-1 changes from the power supply 13 which supplies power to a charging circuit 11, a dc-battery 12, and gas defecation equipment A-2, receives supply of power from a power supply (electric power supply station) 14 suitably, and is charged by the dc-battery 12 through a charging circuit 11. The box of this invention is used for conveyance (carrier), and continuous running of the gas defecation equipment A-2 under conveyance is carried out like the above by the supply from the power supply 13 of the power charged by the dc-battery 12 in this power unit A-1. If it can charge and an electric power supply can be carried out suitably, any are sufficient as a dc-battery 12, for example, it has Li ion cell and a Ni-H battery. The interval of conveyance is installed by the waiting circle place stocker etc. the load boat of a power supply 14, for example, semiconductor processing equipment, and into the waiting for a process, and the box 10 of this invention where the gas defecation unit A was unified is carried out like the above, and receives an electric power supply in a dc-battery 12. the cleaning of the gas using the photoelectron and/or photocatalyst of the above [the inside of a box] by this -- under conveyance of a box and installation -- that is, since it is carried out continuously, clean space is overly maintained in a box

[0033] Next, use of generation of heat from the power unit A-1 which is the feature of this invention is explained. Electronic parts (an example, a power transistor, power FET) with much generation of heat and electronic parts with little generation of heat are in a power unit A-1 by use, in this invention, the heat from electronic parts with much generation of heat is told to the aforementioned gas defecation equipment A-2, and a gaseous flow is promoted. Drawing 8 (a) and (b) explain this. First, drawing 8 (a) is explained. Generation of heat from the electronic parts 15 generated by operation is told to the wall surface 17 of gas defecation equipment A-2 through a heat sink 16. 18 is a ***** sheet for telling this heat efficiently. 18 can use ***** grease and an epoxy resin adhesive in addition to this sheet. Here, if a heat sink 16 is a material which tells heat efficiently, any are sufficient as it, for example, it has Cu and aluminum. Usually, since a weight's being light and cost are comparatively cheap, aluminum is desirable. 19 is electronic parts with little generation of heat installed on the printed-circuit board 20.

[0034] Thus, generation of heat from the electronic parts 15 with much generation of heat is told to the wall surface of gas

defecation equipment A-2. Since the circulating load of the gas in this equipment A-2 is accelerated by deployment of this generation of heat, cleaning in a box is carried out effectively. Since the cleaning of the aforementioned gas of this invention is based on the flow of the gas caused by generation of heat from the light sources, such as a ultraviolet ray lamp, although it is essentially loose, since a gaseous flow is accelerated by use of generation of heat from the aforementioned electronic parts, it becomes effective. Next, drawing 8 (b) is explained. Drawing 8 (b) installs a heat sink 16 in the interior of above gas defecation equipment directly through a wall surface 17. In drawing 8 (b), the same sign as drawing 8 (a) expresses the same meaning.

[0035] this invention can be similarly used [be / under / in the usual clean room / air / beginning / it] in / various / a gas, for example, N2 and Ar. Since pure space is continuously obtained by the electric power supply, this box can be used also not only as conveyance but as a stock box (stocker), and is the feature of this invention. By some kind and military requirement of a box, sources of heating, such as a heater and a lamp, can be installed in the interior because of acceleration of a gaseous flow. By this installation, since removal of a pollutant is accelerated, it can use suitably. Being based on a magnet (magnetism) etc. can perform the unification with the box of the gas defecation equipment of this invention, or a gas defecation unit through the packing material of the gas nature from nothing using the well-known junction method.

[Translation done.]

* NOTICES *

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EXAMPLE

[Example] Next, although an example is shown, this invention is not limited to these examples at all. The wafer conveyance box 21 in example 1 chip fabrication factory is explained using drawing 1. Drawing 1 is a horizontal aperture one apparatus conveyance box. In the chip fabrication factory, the product quality in the clean room of a class 1,000 is manufactured. Since a wafer 22 is processed into a quality (detailed-izing, elaboration) product, it is influenced of the gas-like matter or detailed particulate matter (particle) (membrane formation etc.). That is, in addition to introductory H.C from the open air, 1.1-1.5 ppm of nonmethane hydrocarbons of the degasifying reason from a clean room component and instruments exist in the clean room of a class 1,000 as a gas-like injurious ingredient. On the other hand, since there is generating of a pollutant (the gas-like matter, particle) also from an operator, it is dirty environment near the people for a wafer 22.

[0037] For this reason, a wafer 22 is contained by the wafer conveyance box 21, is conveyed in each process (an example, membrane formation process), and is processed to a quality product. After even the box door 23 and a wafer consist of 24 and a sealant 25, and it is unified, and the breaker style of this box 21 makes the box door 23 engage with a door opener (not illustrating standard [for SEMI]) and pulls it out from a box main part horizontally, when it reduces in a lower part line, the box door 23 is wide opened from the box main part 21. this box 21 -- the automatic carrier robot for clean rooms -- the robot flange 26 -- holding -- the load boat of semiconductor processing equipment -- laying -- after opening of the box door 23 -- a wafer 22 -- the SCARA robot for clean rooms -- every sheet -- loading -- and unloading is carried out. Moreover, after closing the box door 23, it is again conveyed by the automatic carrier robot for clean rooms at the following process processing equipment.

[0038] The gas defecation equipment A-2 which consists of a ultraviolet ray lamp 27, a photocatalyst 28, the photoelectric-emission material 29, the electrode 30 for photoelectric emission from a photoelectric-emission board, and the electric charge particle uptake material 31 is installed in this box 21. The electric power supply from the power supply for the operation of this defecation equipment A-2 is like aforementioned drawing 6, and air clarification in a box 21 is carried out by this equipment A-2. Since this equipment A-2 receives supply of the power from the power supply installed in the load port or the stocker, cleaning is carried out over a long time (pure space is maintained). That is, if it adheres to the hydrocarbon (H. C) and wafer as a gas-like injurious ingredient (harmful gas) adhering to a wafer 22 to which the contact angle of a wafer is made to increase, since an open circuit and a short circuit will be caused in a box 21, a defect is produced in it, and the particle which brings about the fall of the yield exists in it. These pollutants invade in a box 21 from a clean room for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection.

[0039] Here, it is decomposed by the photocatalyst operation by the photocatalyst 28 with which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, and this H.C is changed into the gestalt to which a contact angle is not made to increase. Moreover, the electric charge of the particle (particulate matter) is carried out with the photoelectron 33 emitted from the photoelectric-emission material 29 by which the ultraviolet ray lamp 27 was irradiated, it turns into an electric charge particle, the uptake of this electric charge particle is carried out to an electrode 31 as uptake material of an electric charge particle, and it super-defecates the defecation space section B in which a wafer 22 exists. H.C in a box and movement to the gas defecation equipment A-2 of a particle are based on the flow (inside 34-1 to 34-6 of drawing 1) of the air caused by few temperature gradients of the upper and lower sides in the gas defecation equipment A-2 produced by irradiation of the ultraviolet ray lamp 27 in this equipment A-2. Here, for the product made from P.C., and a ultraviolet ray lamp, a germicidal lamp (254nm) and a photocatalyst are [the quality of the material of a box] TiO₂ to aluminum material. Addition and photoelectric-emission material is [the reticulated SUS (10 V/cm) and electric charge particle uptake material of the electrode for addition and photoelectric emission] SUS material (500 V/cm) about Au at aluminum material.

[0040] 35 in drawing 1 is shading material, and is a **** thing about the irradiation to the wafer 21 of the ultraviolet rays from a ultraviolet ray lamp 27. Moreover, 36 is a diaphragm and is for passing effectively the flow 34-1 to 34-6 of the air by the aforementioned UV irradiation near the wafer. Thus, the harmful gas and the particle in the air in a box 21 are processed, if the air in a box 21 contains substrates, such as a wafer, a contact angle will not increase and overly clarification space will be held rather than a class 1. Since a contact angle does not increase, substrates, such as a wafer, have the effect which adhesion force can form strongly, when membranes are formed on this substrate front face (H. C concentration : 0.1 ppm or less, NH₃ concentration : 1 or less ppb). The defecation space section B of the box where the wafer was contained, and separation are possible for gas defecation equipment A-2, and they are joined through packing material. Separation is

performed for the time/year of time [time of scheduled maintenance], every [for example,], respectively. Thereby, maintenance of the container of the defecation space section (B) with which the wafer in a box is contained, and gas defecation equipment (A-2), and management can be performed easily. 37 is kinematic distributor shaft coupling and is the V groove of positioning.

[0041] The wafer conveyance box in example 2 chip fabrication factory is shown in drawing 2. Since the wafer in this works can disregard the influence of the gas-like matter, it performs only particle removal. With the box 21 of drawing 2, gas defecation equipment A-2 is installed, and this equipment A-2 consists of the electrode 30 for the photoelectric emission from a ultraviolet ray lamp 27, the photoelectric-emission material 29, and the photoelectric-emission material 29, and the electric charge particle uptake material 31. Air clarification in a box 21 is carried out like aforementioned drawing 6 by the electric power supply from the power supply installed in the load port and stocker to this gas defecation equipment A-2. That is, if it adheres to a wafer 22, since an open circuit and a short circuit will be caused in a box 21, a defect is produced in it, and the particle which brings about the fall of the yield exists in it. A particle invades in a box 21 from a clean room (class 1,000) for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection.

[0042] Here, the electric charge of the particle is carried out with the photoelectron 33 emitted from the photoelectric-emission material 29 by which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, it turns into an electric charge particle, the uptake of this electric charge particle is carried out to the electric charge particle uptake material 31, and it super-defecates the defecation space section B in which a wafer 22 exists. Since supply of power is received from a power supply as mentioned above, defecation (air clarification) by gas defecation equipment A-2 is carried out over a long time. Thus, super-clarification space purer than a class 1 is maintained in a box 21. In drawing 2, the same sign as drawing 1 shows the same meaning.

[0043] The wafer conveyance box in example 3 chip fabrication factory is shown in drawing 3. At this works, for the use in clean space purer than a class 10, since the influence of a particle can be disregarded, only gas-like injurious-ingredient removal is performed. The gas defecation equipment A-2 of the box 21 of drawing 3 changes with a ultraviolet ray lamp 27 and a photocatalyst 28. Air clarification in a box 21 is carried out like aforementioned drawing 6 by the electric power supply from the power supply installed in the load port and stocker to this gas defecation equipment A-2. Namely, H.C and NH₃ as a gas-like injurious ingredient (harmful gas) which make the contact angle of a wafer increase to a box 21 when it adheres to a wafer 22 It exists. This harmful gas invades in a box from a clean room for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection. Moreover, depending on the kind of wafer, there is generating (generating of harmful gas) from a wafer front face.

[0044] Here, it is decomposed by the photocatalyst operation by the photocatalyst 28 with which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, these harmful gas is changed into the gestalt to which a contact angle is not made to increase, and it super-defecates the defecation space section B in which a wafer 22 exists. Since supply of power is received from the above power supplies, defecation (air clarification) by gas defecation equipment A-2 is carried out over a long time. With a box 21, even if there is generating of harmful gas from wafer 22 front face, it defecates space in self-cleaning. Thus, the harmful gas in air in a box 21 is processed, and the air in a box 21 will turn into pure air from which the harmful gas which a contact angle does not increase was removed, if substrates, such as a wafer, are contained. (H. C concentration : 0.1 ppm or less, NH₃ concentration : 1 or less ppb) . In drawing 3, the same sign as drawing 1 shows the same meaning.

[0045] The box of the wafer conveyance box 21 shown in drawing 1 of example 4 example 1 another type is shown in drawing 4 . Drawing 4 is an open cassette receipt type horizontal aperture conveyance box, and contains the open cassette 38 which held the wafer 22 in the box of drawing 1 . At breaker guard of this box, since it is held at the open cassette 38, as for a wafer 22, (24 in drawing 1) does not have even a wafer. In drawing 4 , the same sign as drawing 1 shows the same meaning.

[0046] The box of the wafer conveyance box shown in drawing 1 of example 5 example 1 another type is shown in drawing 5 . Drawing 5 is an open cassette receipt type bottom aperture conveyance box, and a box 21 has the breaker style of the box 21 which changes from the box door 23 and a sealant 25 to the pars basilaris ossis occipitalis. That is, this box 21 is a box of a bottom aperture, the breaker style which consists of the box door 23 of a box 21 and a sealant 25 operates by making an opener with an elevator style (not shown) engaged, and dropping it perpendicularly at the box door 23, and the box door 23 is wide opened from this. The inside of this box 21 contains the open cassette 38 holding the wafer 22. In drawing 5 , the same sign as drawing 1 shows the same meaning.

[0047] The wafer conveyance box of composition of having unified the defecation equipment for the harmful gas shown in example 6 drawing 1 and particle removal was installed in the chip fabrication factory of a class 1,000, the following sample gas was put in, UV irradiation was performed, and the contact angle on the wafer contained in the wafer conveyance box and the particle concentration in this box, and nonmethane-hydrocarbon concentration were measured. Here, the electric power supply to a power unit was performed by connecting with the power supply of the stocker in a clean room.

- 1) Size of a conveyance box ; 351, 2 defecation equipment made from P.C. (1) ultraviolet line source ; Germicidal-lamp 4W.
- (2) Photocatalyst material ; On aluminum board, it is TiO₂. It adds by the sol gel process.
- (3) Photoelectric-emission material ; Au is added on aluminum board.
- (4) Electrode for photoelectric emission ; Grid-like SUS material, 20 V/cm.
- (5) Uptake material of an electric charge particle (electrode board) ; An SUS board, 800 V/cm.

[0048] 3) Sample gas (entrance)

Atmosphere : Air, particle concentration : A class 1,000, nonmethane-hydrocarbon concentration : 1.5 ppm four wafers ;

Measurement of a 12 inch 5 measuring instrument contact angle ; Measurement of waterdrop formula contact angle meter particle concentration ; Light-scattering formula particle counter (> 0.1 micrometers)
 Measurement of nonmethane-hydrocarbon concentration ; A gas chromatograph, in addition particle concentration (class) are 1ft3. The total number of the particle 0.1 micrometers or more contained in inside is shown.

[0049] About the contact angle on the wafer contained in the contact angle box on result (1) wafer, a relation with the holding time is shown in drawing 15. In drawing 15, the --- mark shows what has the nothing -**- mark and nothing UV irradiation for what removed the -**- mark and the photocatalyst for what does not set up the electric field for photoelectric emission for the thing of this invention as the -O- mark and comparison.

(2) Particle concentration in a box (class)

The particle concentration (class) in the box of after (1 hour, 2 hours, one day, and one week) is shown in Table 1. As comparison, what does not set up the electric field for photoelectric emission, the thing which removed the photocatalyst, and what has nothing UV irradiation are shown in Table 1.

[0050]

[Table 1]

表 1

数値 : クラス

条件	1時間後	2時間後	1日後	1週間後
本発明のもの	<1	<1	<1	<1
光電子放出用の電場を設定しないもの (光触媒のみ)	1000	900	—	—
光触媒を取り外したもの (光電子のみ)	<1	<1	<1	<1
紫外線照射なしのもの	1000	900	—	—

--: -- measurement -- not carrying out -- the nonmethane-hydrocarbon concentration (ppm) in (3) boxes
 The above, this time, and the same comparison estimate, and it is shown in Table 2.

[0051]

[Table 2]

表 2

数値 : p p m

条件	1時間後	2時間後	1日後	1週間後
本発明のもの	<0.1	<0.1	<0.1	<0.1
光電子放出用の電場を設定しないもの (光触媒のみ)	<0.1	<0.1	<0.1	<0.1
光触媒を取り外したもの (光電子のみ)	1.3	1.2	1.2	1.1
紫外線照射なしのもの	1.4	1.4	1.4	1.3

[0052] In order to check the removal in the space of a nonmethane hydrocarbon also on a wafer, the wafer was contained in the box in the aforementioned conditions, and the phthalic ester on a wafer (DOP, DBP) was investigated.

Measuring method: Desorb the affix on the wafer exposed to the air of the aforementioned conditions for 16 hours, and measure a phthalic ester by the GC/MS method. Consequently, each of what have nothing UV irradiation, and things (only

photocatalyst) which removed the photocatalyst detected the phthalic ester. On the other hand, the phthalic ester detected no things of this invention, and things (only photocatalyst) which do not set up the electric field for photoelectric emission.

[0053] The wafer conveyance box 21 in example 7 chip fabrication factory is explained using drawing 9 and drawing 10.

Drawing 9 and 10 are horizontal aperture one apparatus conveyance boxes, and drawing 10 is the side elevation of drawing 9.

In the chip fabrication factory, the product quality in the clean room of a class 1,000 is manufactured. Since a wafer 22 is processed into a quality (detailed-izing, elaboration) product, it is influenced of the gas-like matter or detailed particulate matter (particle) (membrane formation etc.). That is, in addition to introductory H.C from the open air, 1.1-1.5 ppm of nonmethane hydrocarbons of the degasifying reason from a clean room component and instruments exist in the clean room of a class 1,000 as a gas-like injurious ingredient. On the other hand, since there is generating of a pollutant (the gas-like matter, particle) also from an operator, it is dirty environment near the people for a wafer 22. For this reason, a wafer 22 is contained by the wafer conveyance box 21, is conveyed in each process (example membrane formation process), and is processed to a quality product.

[0054] After even the box door 23 and a wafer consist of 24 and a sealant 25, and are unified, and the breaker style of this box 21 does not carry out door opener illustration of the box door 23, but makes it engage with a standard [for SEMI] one and pulling out from a box main part horizontally, the box door 23 is wide opened from the box main part 21 by reducing in a lower part line. this box 21 -- the automatic carrier robot for clean rooms -- the robot flange 26 -- holding -- the load boat of semiconductor processing equipment -- laying -- after opening of the box door 23 -- a wafer 22 -- the SCARA robot for clean rooms -- every sheet -- loading -- and unloading is carried out. Moreover, after closing the box door 23, it is again conveyed by the automatic carrier robot for clean rooms at the following process processing equipment. The gas defecation unit A (A-1+A-2) which changes from the power unit A-1 with a dc-battery 12 loading charge function which supplies power to the gas defecation equipment A-2 which consists of a ultraviolet ray lamp 27, a photocatalyst 28, the photoelectric-emission material 29, the electrode 30 for photoelectric emission from a photoelectric-emission board, and the electric charge particle uptake material 31, and this gas defecation equipment A-2 is installed in this box 21.

[0055] This power unit A-1 and this gas defecation equipment A-2 in this unit A are like aforementioned drawing 7 and 8, and air clarification in a box 21 is carried out by this unit A. Since supply of power is received from the aforementioned power unit A-1, defecation (air clarification) by gas defecation equipment A-2 is continuously carried out over a long time. That is, if it adheres to the hydrocarbon (H. C) and wafer as a gas-like injurious ingredient (harmful gas) adhering to a wafer 22 to which the contact angle of a wafer is made to increase, since an open circuit and a short circuit will be caused in a box 21, a defect is produced in it, and the particle which brings about the fall of the yield exists in it. These pollutants invade in a box 21 from a clean room for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection.

[0056] Here, it is decomposed by the photocatalyst operation by the photocatalyst 28 with which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, and this H.C is changed into the gestalt to which a contact angle is not made to increase. Moreover, the electric charge of the particle (particulate matter) is carried out with the photoelectron 33 emitted from the photoelectric-emission material 29 by which the ultraviolet ray lamp 27 was irradiated, it turns into an electric charge particle, the uptake of this electric charge particle is carried out to an electrode 31 as uptake material of an electric charge particle, and it super-defecates the defecation space section B in which a wafer 22 exists. H.C in a box and movement to the gas defecation equipment A-2 of a particle are based on the flow (inside 34-1 to 34-6 of drawing 9) of the air caused by few temperature gradients of the upper and lower sides in the gas defecation equipment A-2 produced by irradiation of the ultraviolet ray lamp 27 in this equipment A-2, and generation of heat from a power unit A-1. Here, for the product made from P.C., and a ultraviolet ray lamp, a germicidal lamp (254nm) and a photocatalyst are [the quality of the material of a box] TiO₂ to aluminum material. Addition and photoelectric-emission material is [the reticulated SUS (10 V/cm) and electric charge particle uptake material of the electrode for addition and photoelectric emission] SUS material (500 V/cm) about Au at aluminum material.

[0057] 35 in drawing 9 is shading material, and is a **** thing about the irradiation to the wafer 21 of the ultraviolet rays from a ultraviolet ray lamp 27. Moreover, 36 is a diaphragm and is for passing effectively the flow 34-1 to 34-6 of the air by generation of heat from aforementioned UV irradiation and an aforementioned power unit near the wafer. Thus, the harmful gas and the particle in the air in a box 21 are processed, if the air in a box 21 contains substrates, such as a wafer, a contact angle will not increase and overly clarification space will be held rather than a class 1. Since a contact angle does not increase, substrates, such as a wafer, have the effect which adhesion force can form strongly, when membranes are formed on this substrate front face (H. C concentration : 0.1 ppm or less, NH₃ concentration : 1 ppm or less). The defecation space section B of the box where the wafer was contained, and separation are possible for the gas defecation unit A, and they are joined through packing material. Separation is performed for the time/year of time [time of scheduled maintenance], every for example,], respectively. Thereby, the container of the defecation space section (B) in a box, maintenance of a gas defecation unit (A), and management can be performed easily. 37 is kinematic distributor shaft coupling and is the V groove of positioning.

[0058] The wafer conveyance box in example 8 chip fabrication factory is shown in drawing 11. Since the wafer in this works can disregard the influence of the gas-like matter, it performs only particle removal. The gas defecation equipment A-2 in the box 21 of drawing 11 consists of the electrode 30 for the photoelectric emission from a ultraviolet ray lamp 27, the photoelectric-emission material 29, and the photoelectric-emission material 29, and the electric charge particle uptake material 31. Air clarification in a box 21 is carried out from the gas defecation unit A (A-1+A-2) which changes from the

dc-battery 12 and the power unit A-1 with a loading charge function which supply power to this gas defecation equipment A-2 and this above gas defecation equipment A-2 like aforementioned drawing 7 and 8.

[0059] That is, if it adheres to a wafer 22, since an open circuit and a short circuit will be caused in a box 21, a defect is produced in it, and the particle which brings about the fall of the yield exists in it. A particle invades in a box 21 from a clean room (class 1,000) for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection. Here, the electric charge of the particle is carried out with the photoelectron 33 emitted from the photoelectric-emission material 29 by which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, it turns into an electric charge particle, the uptake of this electric charge particle is carried out to the electric charge particle uptake material 31, and it super-defecates the defecation space section B in which a wafer 22 exists. Since supply of power is received from the aforementioned power unit A-1, defecation (air clarification) by gas defecation equipment A-2 is continuously performed over a long time. Thus, super-clarification space purer than a class 1 is maintained in a box 21. In drawing 11, drawing 9 and the same sign as 10 show the same meaning.

[0060] The wafer conveyance box in example 9 chip fabrication factory is shown in drawing 12. At this works, for the specification in clean space purer than a class 10, since the influence of a particle can be disregarded, only gas-like injurious-ingredient removal is performed. The gas defecation equipment A-2 of the box 21 of drawing 12 changes with a ultraviolet ray lamp 27 and a photocatalyst 28. Air clarification in a box 21 is carried out from aforementioned drawing 7 and the gas defecation unit A (A-1+A-2) which changes from the power unit A-1 with a dc-battery loading charge function which supplies power to this gas defecation equipment A-2 and this above gas defecation equipment A-2 like 8. Namely, H.C and NH3 as a gas-like injurious ingredient (harmful gas) which make the contact angle of a wafer increase to a box 21 when it adheres to a wafer 22 It exists. This harmful gas invades in a box from a clean room for every receipt to the box 21 of a wafer 22, or opening and closing of the box 21 for ejection. Moreover, depending on the kind of wafer, there is generating (generating of harmful gas) from a wafer front face.

[0061] Here, it is decomposed by the photocatalyst operation by the photocatalyst 28 with which the ultraviolet rays from a ultraviolet ray lamp 27 were irradiated, these harmful gas is changed into the gestalt to which a contact angle is not made to increase, and it super-defecates the defecation space section B in which a wafer 22 exists. Since supply of power is received from the aforementioned power unit A-1, defecation (air clarification) by gas defecation equipment A-2 is continuously carried out over a long time. With a box 21, even if there is generating of harmful gas from wafer 22 front face, it defecates space in self-cleaning. Thus, the harmful gas in air in a box 21 is processed, and the air in a box 21 will turn into pure air from which the harmful gas which a contact angle does not increase was removed, if substrates, such as a wafer, are contained. (H. C concentration : 0.1 ppm or less, NH3 concentration : 1 or less ppb). In drawing 12, drawing 9 and the same sign as 10 show the same meaning.

[0062] Drawing 9 of example 10 example 7 and the box of the wafer conveyance box 21 shown in 10 another type are shown in drawing 13. Drawing 13 is an open cassette receipt type horizontal aperture conveyance box, and contains the open cassette 38 which held the wafer 22 in drawing 9 and the box of 10. At breaker guard of this box, since it is held at the open cassette 38, as for a wafer 22, drawing 9, and (11, 12) do not have even a wafer. In drawing 13, drawing 9 and the same sign as 10 show the same meaning.

[0063] Drawing 9 of example 11 example 7 and the box of the wafer conveyance box shown in 10 another type are shown in drawing 14. Drawing 14 is an open cassette receipt type horizontal aperture conveyance box, and a box 21 has the breaker style of the box 21 which changes from the box door 23 and a sealant 25 to the pars basilaris ossis occipitalis. That is, this box 21 is a box of a bottom aperture, the breaker style which consists of the box door 23 of a box 21 and a sealant 25 operates by making an opener with an elevator style (not shown) engaged, and dropping it perpendicularly at the box door 23, and the box door 23 is wide opened from this. The inside of this box 21 contains the open cassette 38 holding the wafer 22. In drawing 14, drawing 9 and the same sign as 10 show the same meaning.

[0064] The wafer conveyance box of composition of having been shown in example 12 drawing 9 is installed in the chip fabrication factory of a class 1,000. The gas defecation unit which becomes the defecation equipment for the harmful gas shown in drawing 9 and particle removal, drawing 7, and this equipment that makes the composition shown in 8 from the power unit with a dc-battery loading charge function for supplying voltage is installed in the interior. The following sample gas was put in, UV irradiation was performed, and the contact angle on the wafer contained in the wafer conveyance box and the particle concentration in this box, and nonmethane-hydrocarbon concentration were measured. Here, the electric power supply to a power unit was performed from the power supply of the stocker in a clean room.

- 1) Size of a conveyance box ; 351, 2 defecation equipment made from P.C. (1) ultraviolet line source ; Germicidal-lamp 4W.
- (2) Photocatalyst material ; On aluminum board, it is TiO2. It adds by the sol gel process.
- (3) Photoelectric-emission material ; Au is added on aluminum board.
- (4) Electrode for photoelectric emission ; Grid-like SUS material, 20 V/cm.
- (5) Uptake material of an electric charge particle (electrode board) ; An SUS board, 800 V/cm.

[0065] 3) Power unit (1) charging circuit ; What was equipped with the voltage monitor circuit in order to charge a dc-battery by optimum conditions.

(2) Dc-battery ; Li ion cell.

(3) Power supply ; Thing equipped with the DC-DC converter and DC-AC converter for supplying the voltage (for germicidal-lamp lighting : AC voltage of 20-50kHz, for [for photoelectric emission] electrodes DC100 V, for the uptake

material of an electric charge particle : DC1,000 V) of a kind required for defecation equipment.

(4) Electronic parts with much generation of heat used for acceleration of the amount of air circulation ; The power transistor and power FET which were used for the DC-DC converter, the DC-AC converter, and the charging circuit.

(5) Heat sink ; aluminum board (thickness : 2mm).

[0066] 4) Sample gas (entrance)

Atmosphere : Air, particle concentration : A class 1,000, nonmethane-hydrocarbon concentration : 1.5 ppm five wafers ;

Measurement of a 12 inch 6 measuring-instrument contact angle ; Measurement of waterdrop formula contact angle meter particle concentration ; Light-scattering formula particle counter (> 0.1 micrometers)

Measurement of nonmethane-hydrocarbon concentration ; A gas chromatograph, in addition particle concentration (class) are 1ft3. The total number of the particle 0.1 micrometers or more contained in inside is shown.

[0067] About the contact angle on the wafer contained in the contact angle box on result (1) wafer, a relation with the holding time is shown in drawing 16. In drawing 16, the --- mark shows what has the nothing -**- mark and nothing UV irradiation for what removed the -**- mark and the photocatalyst for what does not set up the electric field for photoelectric emission for the thing of this invention as the -O- mark and comparison.

(2) Particle concentration in a box (class)

The particle concentration (class) in the box of after (1 hour, 2 hours, one day, and one week) is shown in Table 3. As comparison, what does not set up the electric field for photoelectric emission, the thing which removed the photocatalyst, and what has nothing UV irradiation are shown in Table 3.

[0068]

[Table 3]

表 3

数値：クラス

条件	1時間後	2時間後	1日後	1週間後
本発明のもの	<1	<1	<1	<1
光電子放出用の電場を設定しないもの（光触媒のみ）	1000	800	—	—
光触媒を取り外したもの（光電子のみ）	<1	<1	<1	<1
紫外線照射なしのもの	1000	900	—	—

- : Don't Measure but it is Nonmethane-Hydrocarbon Concentration (Ppm) in (3) Boxes.

The above, this time, and the same comparison estimate, and it is shown in Table 4.

[0069]

[Table 4]

表 4

数値 : ppm

条件	1時間後	2時間後	1日後	1週間後
本発明のもの	<0.1	<0.1	<0.1	<0.1
光電子放出用の電場を設定しないもの（光触媒のみ）	<0.1	<0.1	<0.1	<0.1
光触媒を取り外したもの（光電子のみ）	1.3	1.2	1.2	1.1
紫外線照射なしのもの	1.4	1.4	1.4	1.3

[0070] In order to check the removal in the space of a nonmethane hydrocarbon also on a wafer, the wafer was contained in the box in the aforementioned conditions, and the phthalic ester on a wafer (DOP, DBP) was investigated.

Measuring method: Desorb the affix on the wafer exposed to the air of the aforementioned conditions for 16 hours, and measure a phthalic ester by the GC/MS method. Consequently, each of what have nothing UV irradiation, and things (only photocatalyst) which removed the photocatalyst detected the phthalic ester. On the other hand, the phthalic ester detected no things of this invention, and things (only photocatalyst) which do not set up the electric field for photoelectric emission. In the thing of this invention in the above, it examined by removing a heat sink. A result is shown in drawing 17. A drawing indicates a relation with the holding time to be nonmethane-hydrocarbon concentration. In drawing 17, the -**- mark shows what removed the heat sink as the -O- mark and comparison for the thing of this invention. From drawing 17, a bird clapper understands the removal speed by this defecation equipment early by installation of a heat sink. ** in drawing 17 shows below limit of detection (0.1 ppm).

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The cross section showing an example of the horizontal aperture one apparatus conveyance box of this invention.

[Drawing 2] The cross section showing other examples of the horizontal aperture one apparatus conveyance box of this invention.

[Drawing 3] The cross section showing other examples of the horizontal aperture one apparatus conveyance box of this invention.

[Drawing 4] The cross section showing an example of the open cassette receipt type horizontal aperture conveyance box of this invention.

[Drawing 5] The cross section showing an example of the open cassette receipt type horizontal aperture conveyance box of this invention.

[Drawing 6] The block diagram which connected the gas defecation unit and power supply of this invention.

[Drawing 7] The block diagram which unified the gas defecation equipment and the power unit of this invention.

[Drawing 8] Explanatory drawing for using generation of heat from a power unit.

[Drawing 9] The cross section showing another example of the horizontal aperture one apparatus conveyance box of this invention.

[Drawing 10] The side elevation of drawing 9.

[Drawing 11] The cross section showing other examples of the horizontal aperture one apparatus conveyance box of this invention.

[Drawing 12] The cross section showing other examples of the horizontal aperture one apparatus conveyance box of this invention.

[Drawing 13] The cross section showing an example of the open cassette receipt type horizontal aperture conveyance box of this invention.

[Drawing 14] The cross section showing an example of the open cassette receipt type bottom aperture conveyance box of this invention.

[Drawing 15] The graph which shows change of the contact angle (degree) by the holding time(Sun.).

[Drawing 16] The graph which shows change of the contact angle (degree) by the holding time(Sun.).

[Drawing 17] The graph which shows change of the nonmethane-hydrocarbon concentration (ppm) by the holding time (time).

[Drawing 18] The schematic diagram showing air clarification in the conventional clean room.

[Description of Notations]

A box, 11:charging circuit, 12:dc-battery, 13 : 10: A power supply, 14 : A power supply, 15:electronic parts (generation of heat), 16:heat sink, 17:wall surface, 18: A ***** sheet, 19:electronic parts (there is little generation of heat), 20 : A wiring substrate, 21: A wafer conveyance box, 22:wafer, 23:box door, 24 : A wafer presser-foot seal, 25 : A sealant, 26:robot flange, 27:ultraviolet ray lamp, 28:photocatalyst, 29: Photoelectric-emission material, the electrode for 30:photoelectric emission, 31:electric-charge particle uptake material, 33: A photoelectron, 341-6 : The flow of air, 35:shading material, 36:diaphragm, 37:kinematic distributor shaft coupling, 38: Open cassette

[Translation done.]

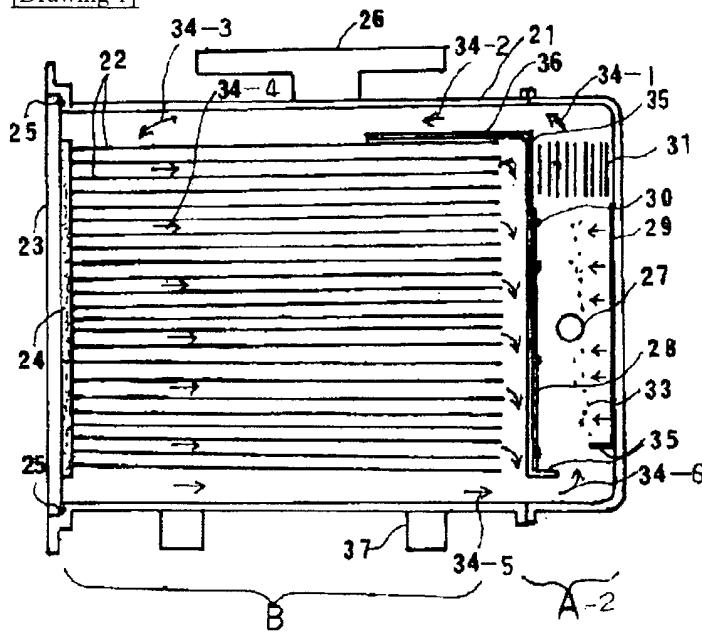
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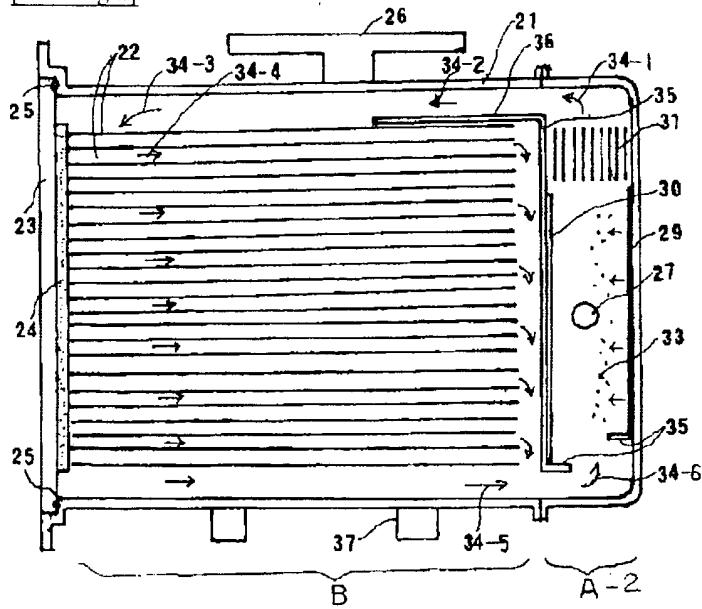
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DRAWINGS

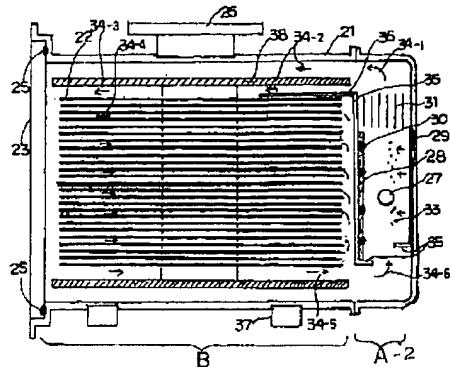
[Drawing 1]



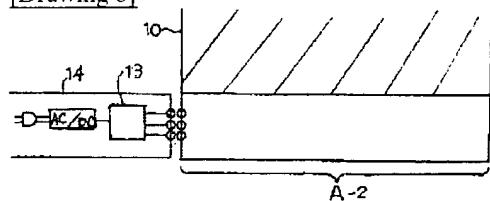
[Drawing 2]



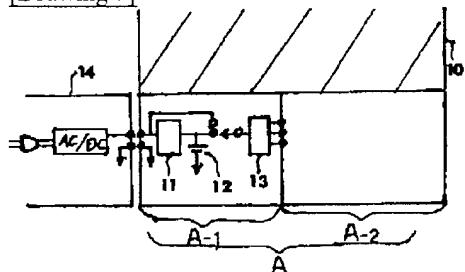
[Drawing 4]



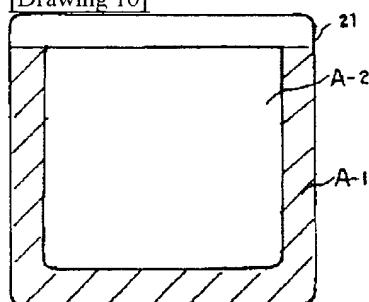
[Drawing 6]



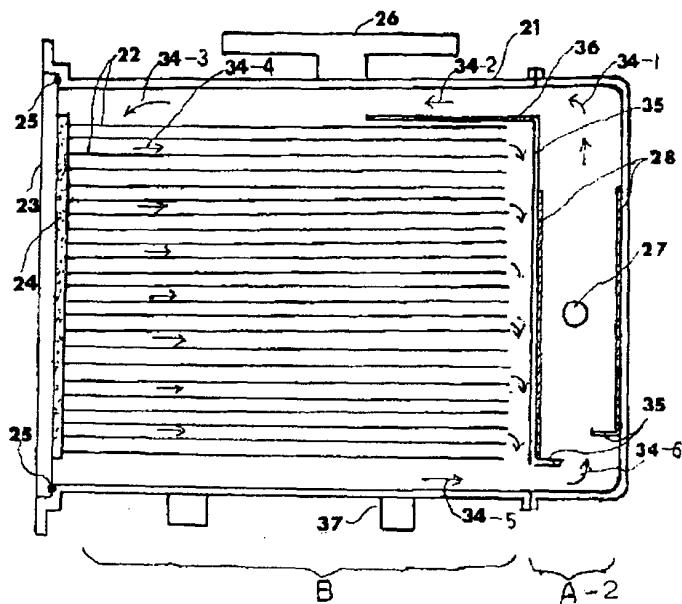
[Drawing 7]



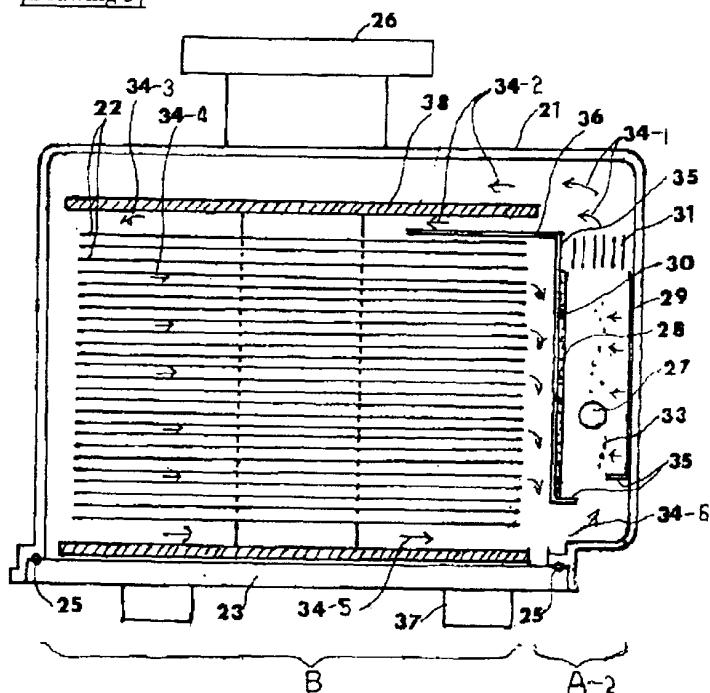
[Drawing 10]



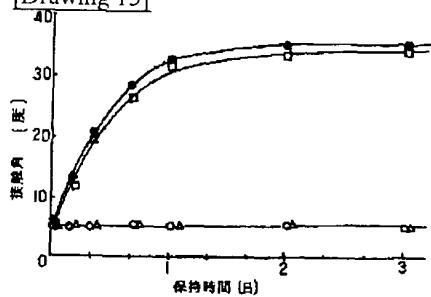
[Drawing 3]



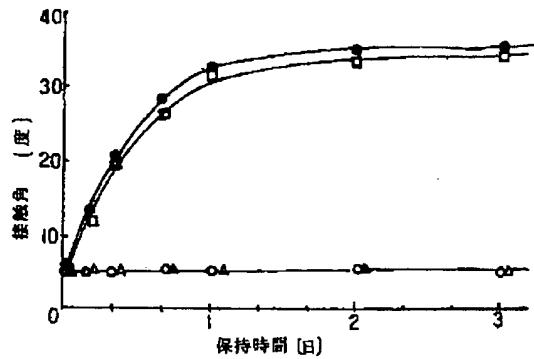
[Drawing 5]



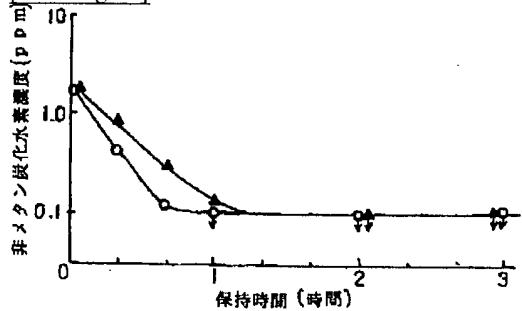
[Drawing 15]



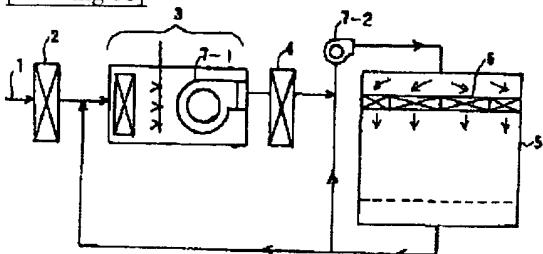
[Drawing 16]



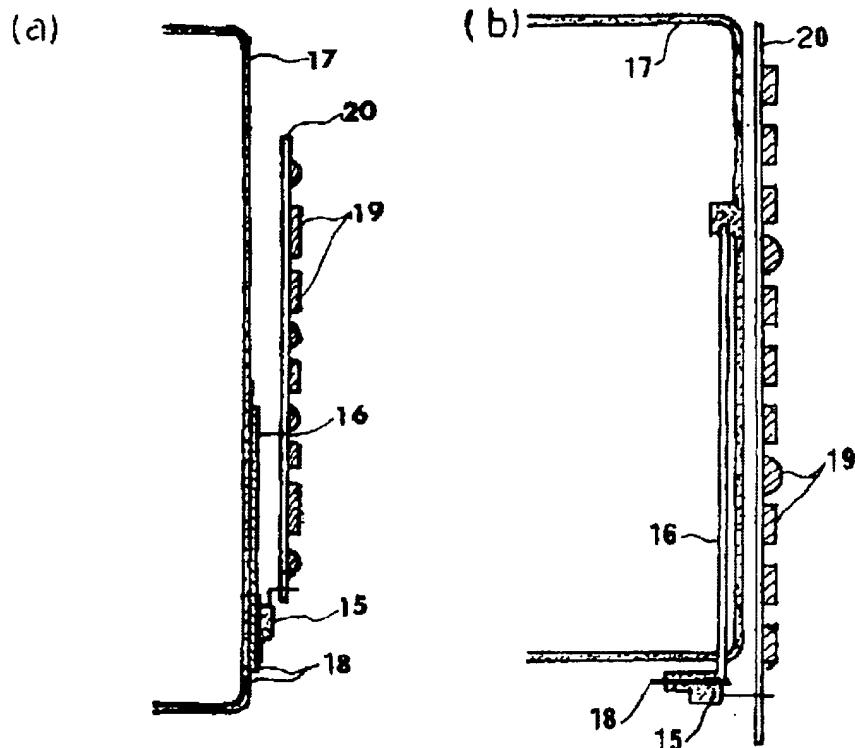
[Drawing 17]



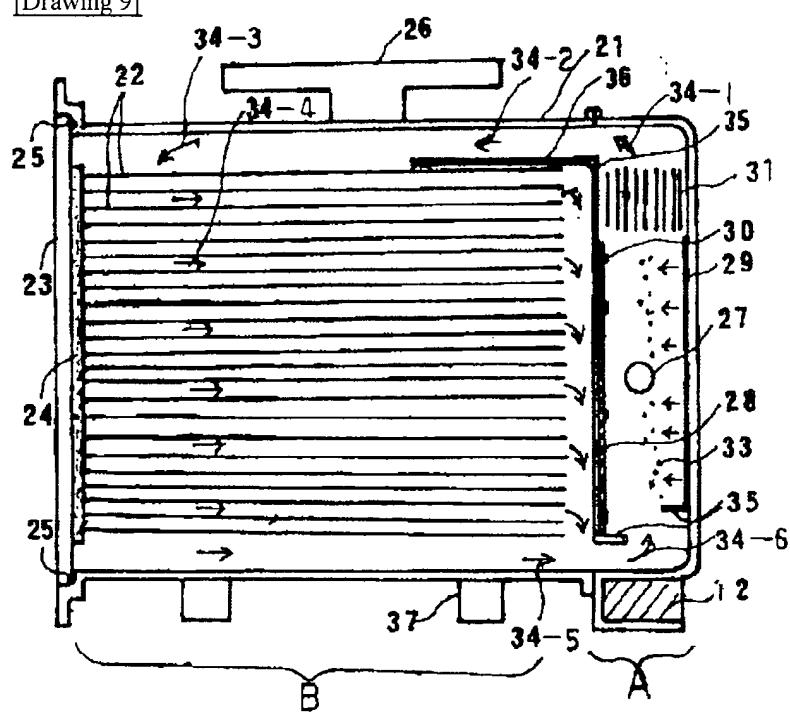
[Drawing 18]



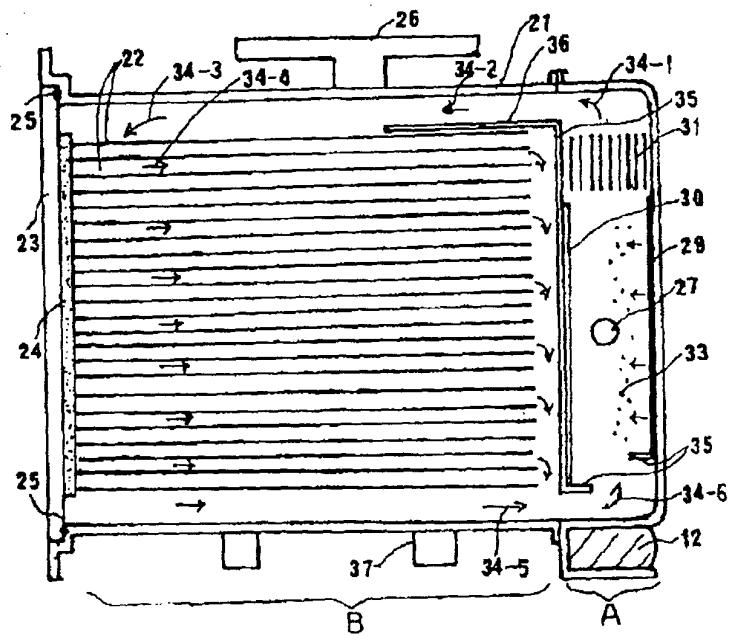
[Drawing 8]



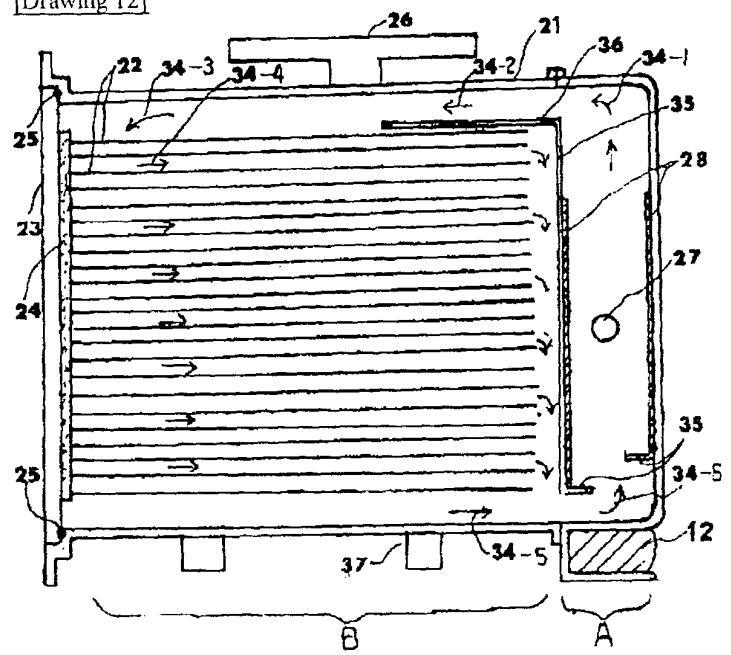
[Drawing 9]



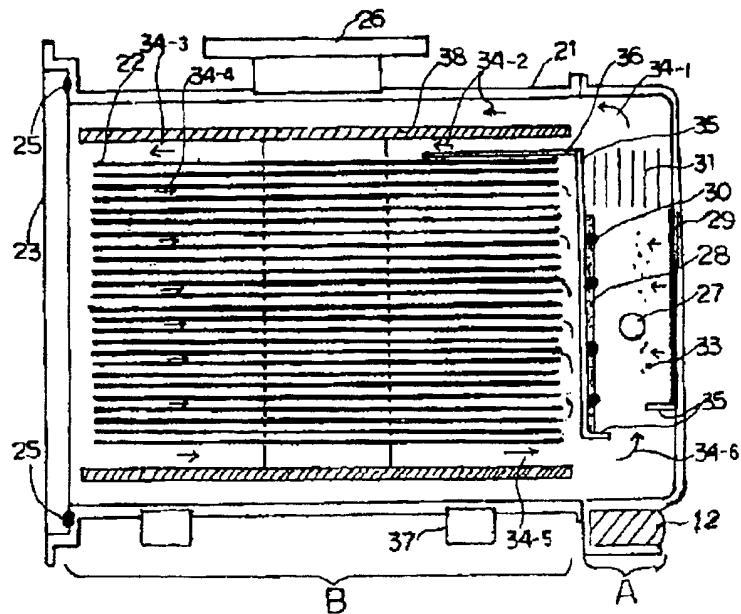
[Drawing 11]



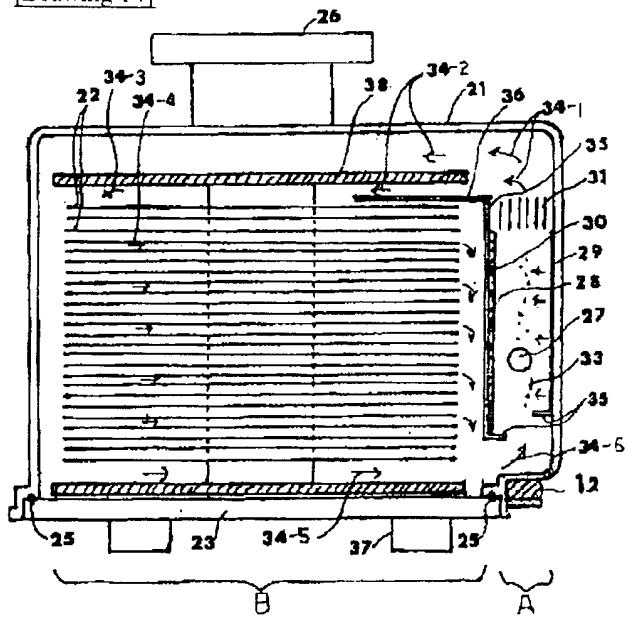
[Drawing 12]



[Drawing 13]



[Drawing 14]



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2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CORRECTION or AMENDMENT

[Official Gazette Type] Printing of the amendment by the convention of 2 of Article 17 of patent law.

[Section partition] The 7th partition of the 2nd section.

[Date of issue] July 3, Heisei 13 (2001. 7.3)

[Publication No.] JP,11-217119,A.

[Date of Publication] August 10, Heisei 11 (1999. 8.10)

[**** format] Open patent official report 11-2172.

[Filing Number] Japanese Patent Application No. 10-67625.

[The 7th edition of International Patent Classification]

B65G 49/00

49/07

[FI]

B65G 49/00

49/07

A

[Procedure revision]

[Filing Date] August 23, Heisei 12 (2000. 8.23)

[Procedure amendment 1]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0009.

[Method of Amendment] Change.

[Proposed Amendment]

[0009] for example, -- 1 it is based on a photoelectron -- pure -- method (removal of particulate matter): JP,3-5859,B, JP,6-74909,B, JP,8-211,B, and JP,7-121369,B 2) The pure method by the photocatalyst (removal of a gas-like injurious ingredient) : JP,9-168722,A, JP,9-205046,A, and 3 The combined-use method of a photoelectron and a photocatalyst (simultaneous removal of a particle and gas): There is JP,1-266864,A. Depending on an application place (kind of equipment), or a military requirement, by the aforementioned pure method, although these pure methods were effective, they need to improve the usage suitably depending on an application place or a military requirement. In this improvement, there was a problem of improving so that it may become practically much more effective. As one of the problem of the, these aforementioned pure methods make a gas fluidize by generation of heat by the light sources, such as ultraviolet rays, and are performing cleaning. That is, it was important how this gas is effectively fluidized depending on the application place of the aforementioned pure method, and it was the problem which should improve.

[Procedure amendment 2]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0015.

[Method of Amendment] Change.

[Proposed Amendment]

[0015] The breaker style of a box may be the aforementioned box in which the gas defecation equipment using the below-mentioned photoelectron and below-mentioned photocatalyst of this invention can be installed and which can be sealed, and any are sufficient as it as long as receipt and ejection can do a substrate suitably. For example, the breaker style of a box consists of a box door, a wafer presser foot, and a sealant, it is unified, and after making a box door engage with a door opener (standard [for SEMI]) and pulling out from a box main part horizontally, a box door is wide opened from a box main part by reducing in a lower part line. As an example of such a box, it is the position of an opening-and-closing door, and the receipt gestalt (is a substrate contained to an open cassette or not?) of a substrate to 1. A horizontal aperture one apparatus conveyance box and 2 An open cassette receipt type horizontal aperture conveyance box and 3 There is an open cassette

receipt type bottom aperture conveyance box.

[Procedure amendment 3]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0031.

[Method of Amendment] Change.

[Proposed Amendment]

[0031] That is, it defecates the inside of a box by installing the box 10 of this invention where gas defecation equipment A-2 was unified in the load port of a power supply 14, for example, semiconductor processing equipment, the waiting circle place in the waiting for a process, a stocker, etc., carrying out the interval of conveyance like the above, and receiving an electric power supply. the cleaning of the gas using the photoelectron and photocatalyst of the above [the inside of a box] by this -- a box -- being waiting (general installation, installation of night, etc.) -- since it is carried out, as for the space in the box where the substrate was contained, clean space is overly created Next, the block diagram of the outline is shown in drawing 5, and the unification with the gas defecation equipment of this invention and a power unit is explained using it. The box 10 of this invention is equipped with the power unit A-1 with a dc-battery loading charge function, and the gas defecation equipment A-2 which uses a photoelectron and a photocatalyst. Here, this power unit A-1 and gas defecation equipment A-2 are unified (a gas defecation unit, A).

[Procedure amendment 4]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0055.

[Method of Amendment] Change.

[Proposed Amendment]

[0055] Example 7.

Drawing 7 of an example 5 and the box of the wafer conveyance box shown in 8 another type are shown in drawing 10.

Drawing 10 is an open cassette receipt type bottom aperture conveyance box, and a box 21 has the breaker style of the box 21 which changes from the box door 23 and a sealant 25 to the pars basilaris ossis occipitalis. That is, this box 21 is a box of a bottom aperture, the breaker style which consists of the box door 23 of a box 21 and a sealant 25 operates by making an opener with an elevator style (not shown) engaged, and dropping it perpendicularly at the box door 23, and the box door 23 is wide opened from this. The inside of this box 21 contains the open cassette 38 holding the wafer 22. In drawing 10, drawing 7 and the same sign as 8 show the same meaning.

[Translation done.]

[Date of request for examination] 23.08.2000
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's
decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number] 3305647
[Date of registration] 10.05.2002
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of
rejection]
[Date of extinction of right]

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